*Home Appliances*



First Published in 1978 by
Orient Paperbacks
(A Division of Vision Books Private Ltd )
36 C Connaught Place New Delhi 110001

Printed by
Kay Kay Printers
150 D Kamla Nagar Delhi 110007

## CONTENTS

List of Illustrations



List of Photographs

*Photographs Courtesy of*
BAJAJ ELECTRICALS LTD &
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NEW DELHI

1

# TOOLS AND PLANTS

For effective repairs to your faulty household electrical appliances you must be properly equipped You must have a tool box which should include the tools and plants as detailed in the pictorial view The functions of each tool is as explained

*Screw Driver Set*

A screw driver set consists of four screw driver shafts of different sizes one punch shaft and one handle which can accommodate any screw driver shaft at a time The screw driver shaft is just slipped into the sleeve of this handle and a ring is tightened The screw driver shaft will not come out Instead of having detachable screw drivers you can have one piece screw drivers of different sizes A screw driver as the name indicates is a tool to tighten and loosen i e drive a screw in or out If you rotate the screw driver clockwise the screw will be driven in If you rotate the screw driver in anti clockwise direction the screw will come out (be driven out)

*Pliers*

A plier is a tool for catching hold of wires twisting them at the ends and for cutting wires It is also used for holding nuts and bolts and acts as a helping hand

# 2

# DOMESTIC POWER SUPPLY

Before learning to handle and repair our electric appliances (gadgets) it is very essential to know the system of our domestic electric supply

To a layman the term electricity is a form of energy which is supplied to factories offices shops and residential buildings through electric wires In a residential building (your house) you would notice that the supply is through two electric wires One of these wires is called the phase wire (live) which carries the current and the other neutral wire which normally does not carry live current These two wires are insulated i e covered with rubber like material (PVC)

There is another wire which is made of steel and is accompanied with the above two insulated wires This third wire is called the earth wire or bearer wire

The earth wire in the feeder cable of our electrical appliance is connected to the bare body of the appliance on one end and the thicker pin in the three pin shoe on other end If there is any leakage of current in the body of the appliance that will flow in the earth wire and not in our body (on touching) and we will not get any severe electric shock

You will further notice that two insulated wires along with a third bare wire come from the electric pole to your house The two insulated wires enter the

electric energy meter installed at your premises by the electricity department The bare wire is connected to the body of the meter and it is further joined to the earth wire of your house which run side by side your house wires

These insulated wires come out of the energy meter and enter the main switch which controls the whole electric supply to your house If the main switch is in on position the electric supply to your house is available and your bulbs fans refrigerators etc work If the main switch is in off' position nothing works

From the main switch we can take out as many circuits as required Each circuit has its individual fuse The earth wire does not contain any fuse and goes to every plug By circuit we mean layout of electrical wiring Fuse is a thin copper wire provided in porcelain cut outs and it blows out in case of any fault and thus electric supply to the premises will be tripped off

*Energy Meter*

The energy meter is installed by the electricity department to record the units of electric energy consumed by your electrical appliances (gadgets) and house lighting The terminal plate (foot cover plate) is always sealed by the electricity department

Whenever any official of the electricity department visits your house to attend any electric complaint or to record the units of electricity consumed by you you should watch that he notes down the correct units i e reads the meter that he does not break any seal of the meter If it happens you should lodge a complaint with the electricity department

On and off, you should check that the energy

meter is in working order For its proper working a disc in the meter with a red spot (which is visible) is always moving in the forward direction whenever you are using the electricity In case the disc stops or rotates backward (anticlockwise) lodge a complaint with the electricity department

*Main Switch*

The main switch controls the entire electric supply to your house In case you want to instal and connect some new plug or you are repairing your ceiling fan or repairing any fuse or plug switch off the main switch i e put down the handle of the switch in off position as long as you are working In case of any fire or electric accident (somebody coming in contact with live wire) main switch should be immediately switched off to save the person The cessation of flow of current will release the body

The main switch also contains fuses provided in the porcelain cut outs This main fuse blows out in case of short circuit (phase wire and natural wire touching each other due to break in insulation) or fault in your electric gadgets This saves the house from fire hazards which can take place due to short circuits

In case of a short circuit there is a spark which may cause fire When the fuse blows out the electric supply is cut off and the spark off is stopped Main fuse also blows out in case of any high voltage surge and saves your electric gadgets from being damaged or burnt

*Fuse*

After the main switch individual circuit (path) fuses are provided A particular fuse will blow out if the

fault is in that particular circuit and the supply to other circuits or rooms will not fail and this will save you from a total failure of supply and panic in your house

The fuse in your electrical appliances can blow due to any of the following reasons

1 High voltage surge on the main line
2 Short circuit in your house wiring
3 Over loading by your electric gadgets
4 Faulty electric gadgets
5 Fluctuation in the electric supply lines

Whenever you want to repair a blown out fuse put the main switch in the off position Check up the circuit fuses (if any) one by one by taking out (drawing out) the male portion The fuse wire in the blown out fuse unit (cut out) will be broken Replace this broken fuse wire with the new fuse wire of 5 amp size

*Three Pin Plugs (Socket)*

A three pin plug has three holes which house brass sleeves The two sleeves (smaller in size) are of the same size One of them is connected to the phase wire and the other is connected to the neutral wire The third bigger size sleeve is connected to the earth wire These are generally of 5 amp capacity or supply rating

For heaters we have bigger size three pin plugs of 15 amps capacity

*Two Pin Plugs (Socket)*

All the modern house wiring provides earth wire along with the phase and neutral wire But in the old house wiring system to provide earth wire was not a practice In these premises only two pin plugs are

used These plugs have two holes One is connected internally to the phase wire and the other to the neutral wire The plug is generally controlled by a switch In on position of the switch the plug is live otherwise it is dead The working of the plug can be tested with the help of a tester When the switch is on the tester when inserted in the phase hole will be lighted You should try the tester in both the holes The one with the phase wire will light the tester Without tester it is not possible to find out which hole is connected to the phase wire and which is to the neutral wire

*Connections of Three/Two Pin Plugs (Sockets)*

Three pin plugs consist of three brass sleeves provided with small screws one per sleeve When you remove the cover of the three pin plug (which is fixed with a screw to the base) the brass sleeves will come out The bare ends of phase neutral and earth wire from the house wiring are drawn into the sleeve and fixed to the sleeves by tightening the screws It matters little to which sleeve you connect the phase or neutral wire But the earth wire must be connected to the thicker sleeve (more in diameter) Then fix the cover to the screw In case of pin plugs there are only two sleeves of same size meant to be connected to phase and neutral wire There is no pin for earth connection

Every plug is controlled by a switch When the switch is in on position the electric supply will come in the plug In case of off position of switch there will be no supply in the plug When the switch is on test the plug with the help of a test pen Insert the test pen in each hole of the plug Where the pen is lighted will indicate the phase hole the other where it is not lighted will indicate neutral wire hole In earth hole also the pen will not be lighted

*Size of the Plugs (Sockets)*

There are two sizes of the plugs The smaller size plug is 5 amp plug This plug is meant to provide electric supply to table fans pedestal fans table lamps and other such appliances which have less wattage rating The bigger size plugs are 15 amp rating These plugs are provided to give electric supply to appliances such as heaters refrigerators ovens hot plates room coolers and air conditioners which have a bigger load or wattage rating

*Connection of the Three/Two Pin Shoe*

If you remove the fixing screw and remove the cover you will notice three or two brass pins as the case be In case of three pin shoe the two pins are of same size whereas the third one is of thicker size At the ends there are holes in three pins and three small fixing side screws are provided The bare ends of the three wire cable are taken into these holes and fixed with the help of side screws

*Size of Shoes*

Like plugs the three pin/two pin shoes have also two sizes The smaller is 5 amp rating and the bigger is 15 amp rating They are connected to the feeder wire depending upon the rating of the electrical appliance for which this feeder wire is to be used

*Switches*

Switches are either tumbler type (ordinary) or piano type They are also rated 5 amp and 15 amps The switches which are used to switch on and off the lights fans and five amps plugs are rated 5 amp

## Units of Measure

*Amperes*

In the electricity wires a type of current flows which is called electric current The electric current is measured in amperes In a layman term the amperage is the measure of strength of current

*Volts*

Voltage is the pressure at which the electric current flows The domestic electric supply is at 230 volts A C 250 volts D C The voltage at which the electrical appliances are to be worked is always stamped on them or under directions in the folder given along with

*Watts*

The power of electric current is measured in terms of wattage or horse power The product of voltage and current is called power or wattage In case of an electrical appliance if voltage is stamped on it and wattage is also mentioned we can find out current to be drawn by the appliance If the current and voltage are mentioned we can find out power of the appliance The simple relation is

Power=voltage x current

Watts=volts (v) x current (I) (amperes)

1000 watts=1 Kilowatt

746 watts=1 Horse Power

Further if a gadget is rated 1000 watts and it works for one hour one unit of electric energy will be recorded on the energy meter The unit of energy consumed will again be the same if the sum total wattage of our house light bulbs tubes etc comes to 1000 watts It will be half unit in one hour if the total wattage is 500

watts and so on

*Cut Out (Fuse Unit)*

As the name indicates the cut out is a protecting device in an electrical circuit which isolates our equipment (electrical gadgets) from the main supply in case of heavy voltage surge on the electrical lines of electricity department Alternatively the cut out saves our appliances against voltage faults on the electrical lines of electricity department The commercial name of a cut out is *Kit Kat*

The main portion of the cut out is wired with a proper sized fuse The general sizes of the fuse wires used are 2 5 amp 5 amp and 10 amp In India the household supply is at 230 volts A C or 250 D C whereas in America it is at 110 volts A C In all English speaking and other European countries supply of electricity to domestic residences shops and hotels for general lighting and electrical gadgets is fixed at 230 volts A C

You always come across wattage when you go to the market to purchase electrical goods Electrical bulbs are rated from 0 watts to 1000 watts General rating is 40 watts 60 watts and 100 watts Electric heaters are rated from 500 watts to 2000 watts Similarly an electrical iron is rated from 500 watts to 2000 watts Electrical ovens and hot plates are rated 1000 watts and above Ceiling fan is about 100 watts rating whereas a table fan is only 60 watts rating Refrigerator is rated about 1/4 HP or about 200 watts Fluorescent tubes are generally 40 watts rating (4 ft tube)

Fuse size for 1000 watts load

$$= \frac{900}{230} \text{ amperes i e 4 amperes}$$

Your one horse power motor for lifting water is of

746 watts rating In case you have a refrigerator normal lighting fans and you use electric press off and on the fuse should be 7 5 amp or 10 amp i e 3 wires of 2 5 size or two wires of 5 amp or single wire of 10 amp size

*Repair of Fuse*

In case a fuse blows out due to fault (heavy voltage surge on the supply lines of electric department or due to over loading by your electrical appliances) pull out the male part of the cut out remove the burnt wire (which will be broken in this case) and rewire the fuse with proper sized wire The connection at the end screws should be made tightly

*Earth Wire*

Normally if we happen to touch a bare wire carrying current at more than 80 volts we will get a severe shock A shock of 230 volts and above may even prove fatal The resistance of our body is very high as compared to earth wire (which is properly earthed either at power house or at our own residence) If the insulation of heating element is damaged in our electric gadget the current from the heating element will spread in the body of gadget If this gadget is accidentally touched by us we will get a severe shock

But when our electric gadget is earthed that is the body of gadget is connected to the earth hole of the three pin plug then the current instead of flowing into our body (on touching will flow through the earth wire to the ground (mother earth) The earth hole in the three pin plug is of bigger size as compared to phase and neutral holes (which are equal in size) Similarly the pin of the three pin shoe is bigger in size as compared to the neutral and phase pins

*Colour of Wires*

The three core cable connected to our electric gadget and three pin shoe has three wires The red is generally connected to phase black to the neutral and green to the earth In case of A C supply (alternating current) connections of red and black wires have no different effect if connected to either of phase or neutral pins but green wire has always to be connected to the earth pin

*D C Supply*

Direct current supply (D C) is always given by private electric supply companies (small companies) Its voltage is 250

*A C Supply (Single Phase and Three Phase)*

It is called alternating current supply Government electricity departments supply A C and modern gadgets (except heating) are used with A C current For heating gadgets the mode of supply does not matter whether it is A C or D C (direct current) In case of single phase A C (household supply) we have got one phase and one neutral In case of three phase the supply is generally given to industries there are three phases in three wires In three phase four wire system for households (big houses having heavy loads) there are three phases and one neutral that is present

3

# LIGHTING SYSTEM

**Switch**

The function of a switch is to provide or break connection of the electric supply If you open a switch by unscrewing the fixed screws you would notice that a small brass assembly moves up or down with the movement of switch knob This indicates the presence or cessation with the fixed contacts

If the contact between the moving unit and fixed contacts (brass strips) becomes loose the function of the switch will be impaired This defect can be easily repaired by pressing the fixed brass strips slightly inwards with the help of a screw driver But never repair a switch when the main switch of your house supply is in on position Always switch off the main switch before repairing a switch or a plug in your house or while doing some wiring fittings

**Plug (Socket)**

A two pin or three pin plug is provided for giving connection to a table fan pedestal fan table lamp or pedestal lamp etc The fault in the plug can be broken connections at the base It can be repaired by removing the cover of the plug If the contact of the shoe pins in the plug sleeves is loose press the sleeves a bit to reduce inside diameter so that the grip of the plug

sleeves is tight on the shoe pins

## ELECTRIC LAMP

An electric lamp is the most common item of lighting in a house This glows and emits lights when switched on This lamp is fixed in a holder by pressing and turning a bit sideways so as to fix the pins provided on its base into the grooves provided at the sides of the holder

The electric lamps are either clear (transparent) or coated white (milky) The lamp consists of a filament So long as this filament is intact, the lamp glows and emits light Whenever this filament breaks due to aging or mishandling the lamp does not glow and is said to be burnt and it should be discarded The normal life of a lamp is about six months But it can be burnt or fused even before due to high or fluctuating voltage (voltage more than 250) at night While purchasing a lamp note the voltage stamped on it Insist for 250 V lamps instead of 230 V as 250 V lamps have longer life The general rating of lamps are 40 watts 60 watts and 100 watts

## NIGHT GLOW LAMPS

There are coloured lamps The rating can be 0 watt to 15 watts These emit soothing and faint light The light is sufficient to see things at night in your room and at the same time not disturbing your sleep Your little baby is also not scared of the darkness at night and the light enables you to take care of an infant without putting on the main light and disturbing others also

## FLUORESCENT TUBES

These are tube like glass envelopes filled with spe

cial gas vapours When switched on these emit day light which is soothing and cool This light is very good for the eyes and is more intense as compared to bulb light The glow is just like daylight and the eyes are not strained if you do your reading in this light The consumption of energy by these tubes is also at least 50 per cent less as compared to the same rating elect ric bulbs The tubes are rated 20 watts (2 feet tubes) and 40 watt (4 feet tubes) Generally 40 watts tubes should be preferred and used for domestic consump tion

## CONSTRUCTION

*Starter*

This is a small metallic cylinder and fits into a holder While fixing put the starter (with the side pro vided with two screw ends) in the holder and rotate side ways to make the contact This starter switches on the tubes and then it is out of circuit

*Choke*

This is a small step up transformer housed inside a small sheet of metallic box filled with an insulated compound The choke actually boosts up the electric supply to the tube and sets the gas vapours glowing and emitting light A bad or damaged choke will burn the tube also

*End Holders*

The tube is provided with a pair of pins at its ends There are two end holders fixed on a metallic strip While fixing the tube let the pins enter the grooves provided in the end holders Rotate the tube through 90 degrees This will make proper connections of the

tube in the end holders and the tube will not fall from the holders

## FAULTS AND REPAIRS

A damaged starter will not switch on the tube To check remove the starter to begin with Make connections at the starter holder by a loop of wire and switch on the tube If the tube is switched on it ascertains that the starter was faulty This faulty starter should be changed immediately

A damaged tube will get blackened at its ends and will not glow or will become reddish or start blinking when switched on

When the choke is damaged it will also affect the tube So, before replacing the tube see that the choke is in order

# 4

# ELECTRIC FANS

An electric fan is a necessity in a country like India where summers are long and very hot Thus they are used by all both rich and poor—in homes in commercial establishments, offices and factories It is used to provide artificial or mechanical circulation of air in the rooms The blow of air to our bodies during summer season helps in the evaporation of sweat and giving coolness to the body Without an electric fan one would feel exhausted in a closed room

## CONSTRUCTION AND OPERATION

An electric fan has a small motor provided with three wings (arms) The size of wings vary depending on the design and requirement of the fan The wings are fixed on rotating part of the motor with the help of fixing screws or they are attached to the rotating shaft The speed of the fan is controlled by a speed regulator (fan regulator)

The electric fans can be divided mainly into four categories viz ceiling fan table fan pedestal fan and exhaust fan

### Ceiling Fan

As the name indicates it is fixed (suspended from) in the ceiling The control switch is fixed on the switch board on the wall The control switch comprises of

off 'on and speed regulator arrangement First position is 'off Then there are figures 1 2 3 4 5, and on The figures are in the ascending order of speed of the fan At position on the speed is full

The size of the ceiling fan is determined by the length of the wings These usually vary from 36 , 42, 48" and 56 The 36 size fan is for a very small room about 8 ×8 The 48" size is a normal size which is sufficient to give air in a normal room of 14' by 12 or 12 feet by 12 The 56" size ceiling fan is for big rooms like drawing rooms office buildings, halls and factories etc

**Table Fan**

A portable fan easy to handle concentrates flow of the air in a particular direction and at a particular place —a few advantages of a table fan Its sizes are 16" and 18 The speed regulator 'off, 'on switch is fixed at the base of the table fan The markings on the speed regulator are on, off slow medium and fast At off position, the fan does not work At other positions it is on and runs at a marked and desired speed The speed control arrangement is either made by rotating a selector switch or individual piano switches are provided for off I II and III or off' fast medium and slow positions of speed

**Pedestal Fan**

The pedestal fan is basically like a table fan but the trunk and base are larger in size and is adjustable in height The trunk is fixed to a broad heavy base to give stability to the fan

The speed control and off on switch is provided either in the middle of the trunk or at the base

In case of both table and pedestal fans a direction

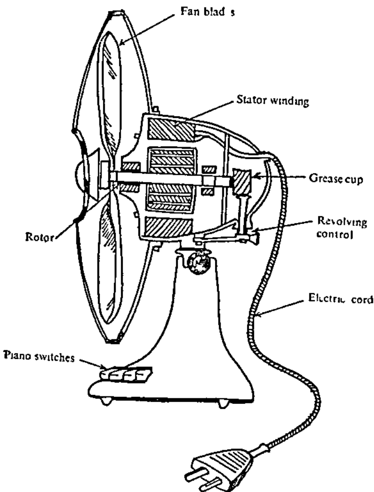

Fan blad s
Stator winding
Grease cup
Revolving control
Rotor
Electric cord
Piano switches

TABLE FAN

control is provided This is gear arrangement and is controlled either by pressing a knob downwards or rotating it to fix or revolving position In fix position the direction of the fan is fixed and the air flow is only in one particular direction In revolving position or pressed position of the knob the fan starts revolving to cover a 180 degree sweep

Exhaust Fan

This is a special type of fan which is fixed in ventilators of big halls to pump out (exhaust) foul air of the room The second important use of the exhaust fan is its provision in the desert room coolers In fact in a desert room cooler the main component is an exhaust fan which serves the purpose

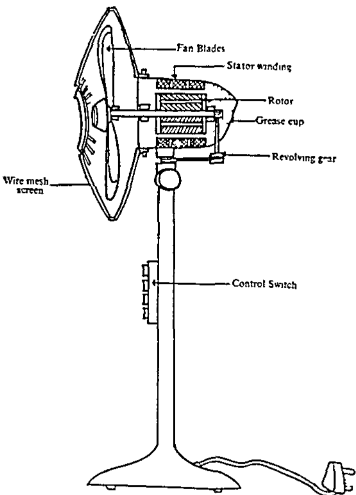
## MAINTENANCE OF FANS

Special care is needed to use and maintain these fans

1 At voltage more than 230 A C or 250 D C (where D C voltage is supplied by the electricity department only D C fans can be used) the regulator should not be set at fast position The fan should always be used at medium speed

2 Never forget to switch off a fan when going out of your house Ceiling fans in particular have been damaged when they were left on and the residents of the house left for a few days holidaying After a continuous running of 24 hours any fan is likely to be heated and damaged So make it a point to give rest to the fan after at least eighth ours of continuous running

3 In winter all the fans should be cleaned The wings of the ceiling fan should be removed washed dried and wrapped in paper and kept in a safe place The body should also be cleaned with a wet cloth and




PEDESTAL FAN

then wrapped with a clean piece of cloth to be re installed the next summer

4 After a couple of years body of each fan should bedismantled and the fan should be cleaned from inside with fresh grease and all the screws and nuts should be oiled

5 Be careful that accidentally or otherwise rain water does not fall on the body of the fan

## FAULTS AND REPAIRS

1 In case of broken connections in the speed regulator the fan will not work The regulator should be opened and broken connections should be repaired

2 If the connections in the body of the fan are broken the fan will not work Open the terminal box fixed to the body of the fan and check for broken connections and repair accordingly

3 Jammed rotating parts prevent the fan fan from moving and working In such a case dismantle the body of the fan and clean and oil the rotating parts

4 As a general practice on every Sunday make a general cleaning of the fans particularly table and pedestal fans and the wings of the ceiling fans

5 Check for broken insulation between the body of the fan and the base wires provided in the speed regulator and repair the damaged insulation by in sulating tapes Leakage in the body could be very damaging

6 In case everything is in order and the fan still does not work it may be that the winding of the fan has been damaged This can be verified by opening the body of the fan If so the winding should be repaired or replaced by an electrician

5

# ELECTRIC HEATERS

Electricity is transmitted to the load centres through transmission lines The transmission line comprises of a conductor wire The size of this conductor wire depends upon the power of the electric current to be transmitted The electric current in turn is the flow of the electrons In a good conducting material the flow of the electrons is normal and there is not much resist ance to their flow These conductors are copper aluminium silver and gold The electric current does not pass through wood rubber plastic and glass etc The flow of electrons is constrained in metals like steel tungsten When there is resistance to the flow of electrons heat is produced in the medium of flow due to internal friction of electrons

The resistance or friction of electrons is increased much more as the area of cross section of the conductor like steel and tungsten is decreased So much so that when an electric current is passed through thin wires of tungsten and steel the wires become red hot and start emitting heat The wire of tungsten or alloy steel are made into coils (to increase the length of wire) When an electric current is passed through these coils (known as heating elements) they become red hot and start emitting heat The bigger the cross section of the wire the higher is the capacity of the heating lement

Most of the domestic electrical appliances have been develop d by employing heating elements in one form or the other

## CONSTRUCTION

Electric heaters employ exposed heating elements These are simple coils of tungsten/steel wire An electric press egg boiler coffee percolator employ heating elements embedded in mica sheets In case of geysers electric kettles and water immersion rods coil ed steel tubes are used housing thin wire heating ele ments insulated from the inner surface of these tubes by means of insulating power In case of cooking range hot plates and costly geysers steel alloy tube elements made into coils are employed for heating purposes In case of Sunflo and hair drier, a fan is placed behind a heating element When the air from the fan flows over the heating element it becomes hot Electric ovens and toaster utilize exposed heating elements

Electric heaters are used both for cooking and heating purposes Although the shapes of these heaters vary in accordance to usage and purpose they serve mechanically their functioning is the same

## PLATE HEATER

### OPERATION

Electric plate heater is fitted with a ceramic plate (round or square in shape) The ceramic plate has slots in which the heating element is housed Through insulating beads the ends of the heating coil are brought out through a three pin assembly One of these pins thicker in size is connected to the body of the heater by means of a bare copper wire The other two pins are connected to the two ends of the coil A three

pin socket provides connections (through a three core cable) to the electric mains supply

Generally plate heaters have only two a pin shoe and two pin sockets Such heaters should be handled carefully because in case of these heaters there is always a greater possibility of getting a shock in case there is broken insulation between the heating coil and the body of the heater

## FAULTS AND REPAIRS

A broken heating coil can be found out by visual inspection of the heating coil Though temporarily it can be repaired by joining the broken coils together but once the coil starts burning and breaking it should be the replaced Frequent burning of coil means that it has served its life

One cause of early burning of coils is the spilling of milk water tea or vegetables on the coil due to over boiling So while working with a heater be careful that nothing spills over on the heating coil

The coil burns at its end due to loose connections and sparking While making new connections at the ends be sure that the connections are tight

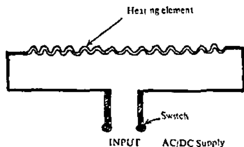
Body leakage takes place (current comes in the body of the heater) due to broken beads at the ends or broken sleeves at the ends of the heating coil

It may also be caused by broken insulation at the shoe pins which are coming out of the heater body

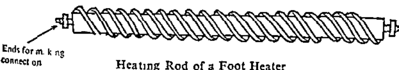
If the insulation at the ends of the coil breaks and the two ends touch each other the main fuse blows out as soon as the heater is switched on

This may also take place when the insulation of the leads in the socket breaks and phase wire and neut al wire come in contact on loss of insulation Open the socket and see if the insulation at the ends of the wire

has melted and the bare conductors are touching together In this case remove the three core/two core wire from the socket and cut a two inch piece from the end Make fresh connections so that fresh wire ends have proper insulation If the insulation of the whole wire length has been damaged the whole three core or two core cable should be replaced with a bigger size cable and superior quality wire While making fresh connections be sure that the green coloured wire is connected to the earth terminal in case of a three pin socket




Electrical Connections in a Heater




Heating Rod of a Foot Heater

## MAINTENANCE

Avoid touching the body of the h ater or any utensil placed on the heater when the heater is on

Put off the heater when you want to remove the

utensil from the heater

When something is spilling from the utensil on the heater which is on do not try to remove it in a hurry without switching off the heater You will get a severe shock in case the heater has not been put off The current in such cases comes from the heating coil through the liquid spilled into the body of the utensil

When a heater is being used the fuse size should be proper Otherwise the fuse will blow out and your house will be without electricity

## FOOT HEATER

### OPERATION

A foot heater consists of a single rod or two rods which are fixed on to a metallic reflecting surface The metallic reflecting surface is a very shining nickel plated metal sheet bent into a parabolic shape One rod is directly connected and is put on when the heater is switched on from the main The second rod is con trolled from a piano switch provided on the heater The rods are made of ceramic former (round hollow rod) The heater wire is coiled on this former

### FAULTS AND REPAIRS

Loose connections at the ends of the heating rod result in sparking Tighten such connections

In case of broken wire at the former the heater wire becomes dead It is very difficult to repair the broken wire on the former The heating rod should therefore be replaced as a whole

Damaged heated wire ends in the three pin shoe should be cut and new connections made

Sometimes the ceramic former can break due to a fall of the heater In this case also the heater rod

should be changed

When you want to change the damaged heating rod loosen the end screws and remove the damaged heating rod Purchase the exact duplicate of this rod from the market as any difference in its length will not fit the heater

Sometimes a protector wire arrangement is provided on the surface of the heater to avoid accidental touch with the heater rod In such cases this wire setting or wire arrangement should be removed carefully before removing the damaged heating rod

# 6

# ELECTRIC IRON

In earlier times when electricity had not reached all the corners of civilization the iron was heated by burning charcoal in it

This is still used by washermen At home people used irons by heating them on ovens or *anghithis* But now electric irons are much in use and people do not use such old style irons at home

In case of an electric press a heating element is embedded between two metallic plates When the electric press is connected to the electric supply the heating element gets heated up and in turn heats the whole press especially the base As a matter of fact the principle of electric iron is identical to that of electrical heater

The electric iron is very safe for ironing the clothes as in an ordinary press there is every danger of burning charcoal falling on your clothes Further it is economical and can be heated up within a couple of minutes There is no soot and fumes from an electric iron as compared to an ordinary charcoal iron

## CONSTRUCTION

The construction of an electric press can be divided into three parts

*Upper Plate*

This is a metallic plate and is provided with a

handle of suitable shape fitted on it On this plate is provided a two pin shoe This plate is light (some times hollow) and thin in size as compared to the base

*Heating Element*

Heating element is shaped like a coil of thin metallic wire embedded in a mica sheet The two ends of the coil come out of the mica sheet for providing external connections These ends are connected to the shoe terminals of the upper plate with all precautions that no bare wire touches any metallic portion of the press



Embedded Heating Element in a Mica Sheet

*Base Plate*

This is a thick solid plate which is quite heavy and the weight of the iron depends upon the weight of the base plate This base plate is very smooth and highly polished so that it does not rust even when it comes in contact with wet clothes

*Assembly*

The heating element is placed between the upper and lower plates The upper and base plates are fixed together through a centre bolt The handle is fitted to the upper plate by means of screws The handle is made of fibre plastic (fire proof and heat resistant)

*Provision of Earth Wire*

Inside the metallic assembly provision is made for an earth connection and it is brought to the earth terminal on the shoe Instead of a three pin shoe we can make arrangement for connecting three core wires to the three terminals of the press i e two terminals of the heating element and one earth terminal

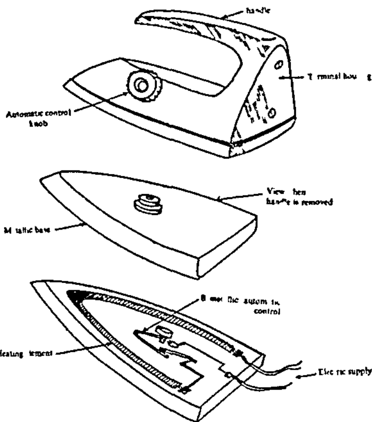
## AUTOMATIC ELECTRIC IRON

### CONSTRUCTION

In case of an automatic electric iron a bimetallic thermostat control switch is provided on the top of the press The indicating knob can be rotated clockwise or anti clockwise in accordance with the heat required for different materials The settings are nylon rayon silk wool cotton and linen The lowest heating point is at nylon and highest is at linen When the press has been heated to the indicated point (temperature) the connection to the main supply is broken automatically and the indicator that is attached near the handle is switches off Always move the indicator knob to the point corresponding to the type of cloth to be ironed

### FAULTS AND REPAIRS

In case of broken wire in the heating element the iron will not get heated even if everything outside is in order To have an access to the heating element of the iron you will have to dismantle the whole electric iron Visually inspect the heating elements and see if the wire is broken anywhere In case it is the heating element shall need replacement A heating element also needs replacing if it has a punctured or damaged insulation Exact duplicate of the heating element




AUTOMATIC ELECTRIC IRON

could be obtained from market by showing the damaged one to the shopkeeper

*Broken Connections*

Due to more resistance at the joints local heating takes place This eats up the metal at the junction (end connections) and the joints become loose When the joints become loose the joints start sparking This practically burns the metal at the joints and the connections at the joints break The joints are inside the terminal housing of the press where th leads of the heating element are joined to the three core wire coming out of the body of the press To detect the broken connections unscrew the cover at the back of the handle of the press This would reveal the terminal connections and you can look for any broken connection The other place for broken connections can be in the three pin shoe Open the shoe cover and find out if there is any broken connection

*Short Circuit in the Feed Wire*

By short circuit we mean when natural and phase wire (bare conductors) come in contact due to broken insulation of the wires This is caused when the size of the cable used for the iron is under sized and the insulation is damaged due to heat in the conductor Such a cable should be replaced as a whole

*Defect in the Automatic Control*

Defect in the automatic control is the last item to have become defective In this case the circuit will not be completed and the iron will not be heated as desired If you are able to get a duplicate of your automatic control replace the damaged one with this new one If the contacts are rusted they should be clean-

ed with sand paper and washed with petrol Never oil them as the oil is an insulating material If the elasticity of the bimetallic strip is lost then you may forge it at one middle heat point say cotton In this case your automatic control will be lost and you can use your automatic iron as an ordinary *electric iron*

*Shocks*

Electric iron may give shocks due to broken insulation of heating element or broken insulation at the terminal points Heating element with damaged mica insulation should be replaced Insulation at terminal points can be repaired either by insulation tape or insulation compound

Another cause of shock is when out of ignorance or in a hurry someone connects the earth wire with the phase point in the three pin shoe In such a case the body of the iron will get charged and give severe electric shock on touching

## MAINTENANCE

1 After repairing the iron you must test it with the help of a test pen Place the test pen on all metallic parts of the iron turn by turn when the iron is on and see that the test indicator does not glow If it glows it means that current is passing in it and it will give a shock when you touch that portion

2 While ironing clothes, as a habit and precaution wear rubber slippers or stand on some wooden plank

3 Never iron wet clothes This will rust the iron and the nickel/chrome polish will get spoiled

4 If the iron is not automatic do not heat it too much and before ironing the garment try it on a rough and ordinary cloth If it has become very hot you can switch it off till it cools down a bit This will

prevent your clothes from burning

5 In case of an automatic press set the automatic chart indicator in accordance with the clothes you press

6 It is a good habit to switch off the iron when it is being used for ironing the clothes

# 7

# HOT PLATES

Heating plates in one unit or two units are a replace ment for gas ovens or coal hearth This is a safer method of heating as there is no danger of gas leakage and fire hazard in your kitchen nor are there any fumes This method of heating is somewhat costlier as compared to gas heating but it is a very safe neat and clean method of heating Where electricity is cheap it s consumption of electricity may be equal or even less than gas

## CONSTRUCTION

A hot plate is a modified ordinary plate heater The difference being that the heating element is embed ded beneath a thick metallic plate (generally round in shape) The heating element is fully insulated from the body of the heating plate A double heating plate set appears like a gas oven There is a control switch pro vided in front of each hot plate The indications on the regulator are Off I II and III or low medium and high The heat given out at the plates is low me dium and high against regulator positions of I II and III, respectively The regulation of heat is provided so as to suit the cooking requirement At position I, only one heating element is in circuit At position II two heating elements are put into circuit A three pin shoe two pin shoe type arrangement is provided at the

side of heating plate for connecting socket of feeding wire

## MAINTENANCE

1 Always use a pressure cooker for preparing vege tables meat and pulses so that nothing spills over these plates

2 While preparing tea or boiling milk be careful that the milk or tea does not spill over these plates

3 Off and on check the insulation of the heating plates for any leakage with the help of a test pen In case of any leakage do not touch the body of the heating plates

4 The feeder wire should be of proper size that is 3/22 size copper wire for single heating plates or 7/22 size copper wire (cable) for twin heating plates The number of wires in the cable depends on whether you want to connect the hot plate with a two pin socket or a three pin socket

5 The connections of the feeder cable should be tight at the socket as well as in the shoe

6 The plug switch and shoes should be of 15 amp size

7 If your kitchen is equipped with hot plates ovens refrigerator etc you must have a separate house wir ing circuit for these controlled from an independent fuse unit This circuit is called power circuit or heat ing circuit

## FAULTS AND REPAIRS

1 Loose connections and molten wire ends in the socket and three pin shoe should be repaired immedia tely

2 An undersized feeder cables will be melted and short circuited on its entire length Such a cable can be

detected when you do not come across good wires after cutting the cables a couple of inches from the ends

3 Leakage in the heating plates is another fault to be checked

This means insulation of the heating element has been damaged or the insulation at the three pin shoe point is damaged The hot plate should be dis mantled to find out whether it is the heating elements or the three pin/two pin body shoe which needs a change

6 In case of damaged heating element the insula tion of heating elements is damaged or the wire of heating element has been broken the heating elements should be replaced with a new one

7 One general defect that can take place is in the regulator i e the loss of moving arm contact with the terminals of heating element This defect can be repaired by bending the arm towards the terminal points Tips of the moving arm and fixed contacts at the terminals should be cleaned with zero number sand paper and petrol to remove dirt dust and oxide for mation

8 In case the hot plate does not get heated when the switch on wall is put on and the regulator is on any of three position (I II and III) the points to be check-ed are connections in the shoe socket condition of cable connections at the regulator and the condition of the heating element

8

# ELECTRIC WATER IMMERSION ROD

## CONSTRUCTION

This is a domestic electric appliance for heating water in a bucket From the outside it appears as a chromium plated thin steel tube made into a coil The ends are housed in a bakelite socket Inside the hollow steel tubing a heating element is provided which is insulated from the steel tubing body by placing insulat ing compound around the heating element The heating element is made of a very high resistance wire The ends of this wire (coil) are taken out from the hollow ends of the steel tubing The electrical connections to these ends are made in the socket The water immer sion rod is rated 500 watts 750 watts or 1000 watts

## OPERATION

As mentioned above the electric immersion rod is used for heating water The water is put into a bucket The immersion rod is placed in the bucket so that it hangs from the top of the bucket from a hook attached to the rod The immersion rod should dip into the water upto the marked water level on the rod The three pin shoe of the electric rod is inserted into the three pin wall socket The electric switch is turned on Whenever an electric heater or any such appliance is switched on the house light exhibits a dim in its brightness This indicates that the electric heating

appliance has started working

Another indication that the electric rod is working is that the energy meter disc will start moving fast Yet another indication is the water bubbles which start collecting around the dipped portion of the water immersion rod and a hissing sound is produced But never touch the water with hand to find out if it has started heating because a leaking electric immersion rod will pass current into the water and the water will give a severe shock to you

## MAINTENANCE

1 The water level in the bucket must be to the level marked water on the immersion rod

2 First place the rod in the water and then switch it on

3 If you want to know the temperature of water switch off the rod take out the three pin shoe from the plug and feel the water for its temperature If you want to heat the water more again put the shoe in the plug and switch on the rod

4 Never touch the water while the immersion rod is on

5 Always heat the water in a metallic bucket and not in a plastic bucket In case of a plastic bucket the heat will damage it when in contact

6 Off and on test your immersion rod with a tester In case of any leakage the tester indicator will glow

7 Never switch on a rod without water If you do it it will be damaged

8 An immersion rod whose insulation has been damaged i e the current leaks into the water and the tester glows when touched with the bucket the immersion rod should be discarded as there is danger

of getting an electric shock

## FAULTS AND REPAIRS

1 A general fault is the melting of wire insulation at the ends in the socket or in the three pin shoe The wire can be repaired by cutting the melted portion of wire by a couple of inches and making fresh connec tions

2 Sometimes the bakelite body of three pin shoe is damaged due to sparking at the pins from loose sleeves of the three pin plug In such a case pro per sized shoe should be obtained from the market or damaged one replaced

3 Be careful about connections in the socket and three pin shoe The green wire must be connected with the earth pin The connections should always be right

4 In case of loose sleeves of the plug open the plug and press the sleeves with pliers

# 9

# ELECTRIC KETTLE

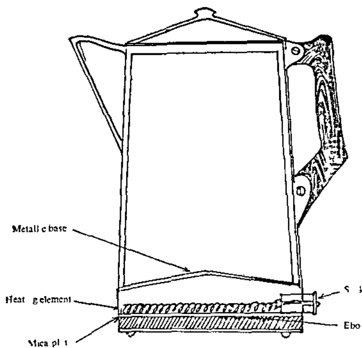
It is a boon to a housewife in winter or in case of an emergency Fill the kettle with water and switch on the kettle Within a couple of minutes the water will start boiling and will be ready for your tea or coffee In winters you can thus make tea while remain ing in bed

## CONSTRUCTION AND OPERATION

The electric kettle as the name indicates is a stainless steel *kettle An immersion type water heater* rod is fixed in the kettle In an ordinary type of electric kettle the heating element is embedded in the hollow base of the electric kettle A three pin shoe of suitable shape and design is fixed at the side of the kettle body and is connected internally to the water heater rod A three core cable is connected at one of its ends with a special type socket and on other (cable having three wires) and a three pin shoe is connected for making electric connections to the three pin wall plug In case of an ordinary socket you have to switch off the line when the water starts boiling in the kettle but in case of special type socket the con nection is automatically broken by a bi metallic strip provided in the socket at boiling temperature

## MAINTENANCE

1 The quantity of water in the kettle should be to




ELECTRIC KETTLE

the extent that the immersion rod is *fully dipped in* water

2 In case of an ordinary type socket the wall switch should be put off when the water in the kettle starts boiling

3 Off and on the body of the kettle should be checked with the help of a test pen to check any leakage of current and avoid the danger of an electric shock on touching

4 Never switch on the kettle without water

5 Never use this kettle for boiling milk

6 As a general rule always handle the kettle when the wall switch is off

## FAULTS AND REPAIRS

1 Broken connections in the socket and three pin shoe could be easily repaired by opening the socket and three pin shoe

2 In case of molten wire ends in the socket and three pin shoe remove the connections of the feeder wire from the three pin shoe and socket Cut out the damaged portion of wire from both ends and make fresh connections to the socket and three pin shoe

3 Any electrical leakage in the kettle may be due to the damaged insulation in three pin shoe fixed to the kettle Remove this shoe and replace it with a new one It may be that you are able to repair this leak age by just providing a rubber sleeve between the three pin shoe and the body of the kettle

4 If feeder wire three pin shoe socket plugs and switch are in order and the water in the kettle does not get heated (when the wall switch is put on) it means that the immersion rod has been damaged A leaking immersion rod or damaged immersion rod needs replacement

# 10

## COFFEE PERCOLATOR

For preparing black coffee coffee percolator is an ideal appliance But if you are not accustomed to take black coffee you may add milk to your taste and use the percolator The shape of the coffee percolator is that of a metallic jar A sieve cup with a perforated lid rests on a shaft The shaft is mounted on a flat metallic base The jar is covered at the top with a glass cap

### OPERATION

First remove the glass cap and then take out the sieve cup mounted on the shaft Fill the water in the hollow Place the shaft in position Put the sieve cup on the shaft The level of water should be below the bottom of the sieve cup Put dry granular coffee (not instant) in the cup and cover the cup with a perforated lid Place the glass cup in position Switch on electric supply to the coffee percolator When the water in the jar is heated to boiling temperature, it starts jumping through the perforated coffee cup into the hollow glass cup This way the coffee is filtered into the hot water

After the water has boiled for three to four minutes switch off the coffee percolator and drain out the black coffee from the stop cork into the cups and add milk and sugar to your taste

## MAINTENANCE

1 The coffee used should be granular and quantity used should be one teaspoon per cup of water added to the coffee percolator

2 The water level in the coffee percolator should be below the sieve cup bottom or at the point marked *water level* on the coffee percolator

3 The connections in the socket and three pin shoe should be tight to avoid sparking and melting of wire ends

4 Off and on test the body of the coffee percolator with the help of a pen tester to detect any leakage

5 After use the coffee percolator should be thoroughly cleaned Avoid flushing water on the out side of the coffee percolator as water may leak into the heating element and damage it You should clean the outside with a wet cloth

## FAULTS AND REPAIRS

1 A general fault can be with the connections in the socket three pin/two pin shoe or feeder wire (cable) This fault can be repaired easily as in any of the electrical appliance

2 The current leakage in the body of coffee percolator can be detected by switching on the coffee percolator and touching the metallic body of the coffee percolator with a test pen at different points In case of leakage the indicator in the test pen will start glowing The leakage can be due to punctured mica insulation of heating elements Such an element should be replaced

3 In case of damaged heating element the coffee percolator will not get heated even if everything else is in order Such an element should be replaced

## 11

# EGG BOILER

### CONSTRUCTION

An egg boiler is a small glove type electrical appliance for boiling eggs It is made in two parts The lower part consists of the heating element and the water plate which has 6 round holes for placing 6 eggs in a vertical position The other half is a hollow metallic lid

Water is filled in the water plate (about 1/2 inch thick layer of water) Eggs are placed in the six round holes The lid is placed tight on the lower half of the egg boiler The electric supply is switched on Due to the heat of boiling water and steam the eggs are boiled They can be half boiled or full boiled depending upon the time the electric supply is kept on In two minutes you can get half boiled eggs and in 4 to 5 minutes you can get full boiled eggs

### MAINTENANCE

1 Do not forget to put water before placing eggs in the holes

2 Keep caution while boiling eggs to avoid hard boiling

3 The lid should fit tightly

4 Check periodically for electric current leakage into the metallic body of egg boiler

## FAULTS AND REPAIRS

1 Broken connections in the three pin shoe or at the terminals of egg boiler

2 Wrong connection of earth wire

3 Leakage in the body of egg boiler

4 Damaged heating element

The first two defects can be repaired easily as explained for any electrical appliance

The leakage in the body of egg boiler may be due to broken insulation between the heating element and the metallic body of the egg boiler A damaged heating element or one with punctured mica insulation should be replaced The heating element can be inspected by opening the base of egg boiler Visual inspection of the heating element will locate its fault

## 12

## ELECTRIC TOASTER

Bread slices are best roasted light brown in an electric toaster The heat is controlled and uniform all over You can roast two bread slices at a time The control is either manual or automatic

### CONSTRUCTION

This is a small box type metal sheet construction Two metal strips attached with a lever and provided with a spring action are housed in a toaster A button is provided to release the pressure of the springs Heating elements are provided at the sides to give uniform heat to the bread slices The slices are placed on the metal strips and the lever is pulled down The metal strips are held down in position with the help of a hook When the side button is pressed the hook releases the pressure and the bread slices pop out

### OPERATION

1 In case of electric toaster which is manual plug in the toaster and switch on

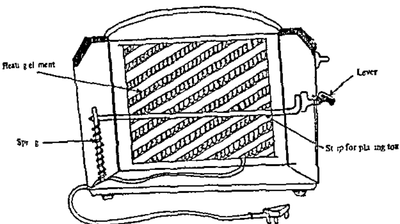
2 Insert two slices of bread

3 Pull down the lever and hold it down

4 After about a minute lift up the lever

5 See if the toasting is proper otherwise increase the timing

6 In case of an automatic toaster the time is set at




Electric Toaster

the timer and the bread slices after toasting pop out automatically In an automatic toaster when the bread slices are lifted up the heating element is also switch ed off

## MAINTENANCE

1 After use make sure that all crumbs are removed from the toaster by opening the small window at the base Therefore gently shake the toaster to remove these crumbs But do not insert any brush or metal ins trument through the base as it may damage the heat ing elements and spring mechanism

2 Always use three pin plug (shoe) with proper earthing for safety

3 Do not insert any metallic instrument such as knife or spoon while the toaster is on This would give a shock

4 Do not roast slices of uneven thickness or broken slices This will jam the toaster

5 Check off and on for any leakage

## FAULTS AND REPAIRS

1 Broken connections in the three pin shoe or at the terminals of the toaster

2 Damaged insulation at the ends of feeder cable

3 Damaged heating element

4 Body leakage

The first two defects can be repaired easily

For body leakage look for damaged insulation inside the toaster or at its terminals If the toaster does not get heated even if everything is in order then the heating elements must have been damaged The physical inspection of the heating elements will locate the damage Hence the damaged heating elements should be replaced

13

# ELECTRIC OVEN AND TANDOOR

**Oven**

The electric ovens are of two types Oven is primarily for placing cooked foodstuffs so as to keep them warm This is also called hot case The other type has a provision for baking also

## CONSTRUCTION

The oven for placing food stuffs looks like a small cabinet It has a small door in front Three or four racks are provided for stacking different foodstuffs The sides and the back of this cabinet are made of hollow steel sheet so that the inside heat is not dissipated easily to the outside atmosphere

The heating elements are fully insulated from the metallic body of this cabinet and are placed at the base The temperature inside the oven is controlled with the help of a thermostat control switch The temperature can be set at any desired degree

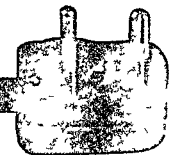
When the inside temperature reaches the set point on the switch the heaters are put off automatically The heater switches on again when the inside temperature falls below the set temperature Another switch controlling the electric supply to the oven has four positions viz. *On pre heat grill* and *bake* During winter, and in cold countries, an oven is a boon for

wires If you switch on the oven the fuse will blow out Such a feeder cable should be replaced

In case of sophisticated ovens (cooking range) the heating element is a coiled metallic tube which is not damaged easily and is a very robust heating element. In ordinary ovens the heating element is in the form of a coil of thin tungsten or steel wire wound round a ceramic former or mica strip These coils have less life The broken wire in the coils can be easily detected The damaged heating element in any case needs to be replaced

The leakage in the body of oven can be due to damaged insulation either at the oven terminals or wrong connections in the three pin shoe or due to damaged insulation between the heating element and the metallic body surface The repair can be carried out by providing necessary insulation by insulation tapes (PVC, black or empire tape)







Plugs
and
Sockets





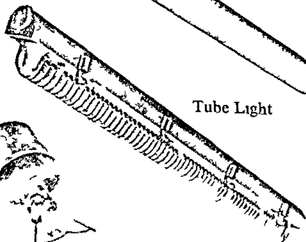
Energy Meter



Choke and Starter



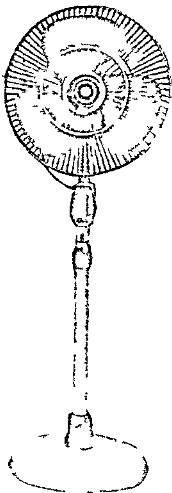
Ceiling Fan

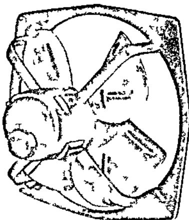


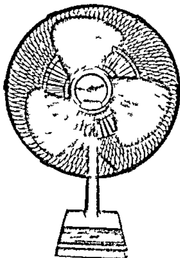
Tube Light

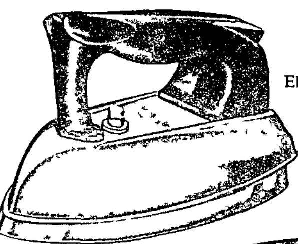


Electric Bulb

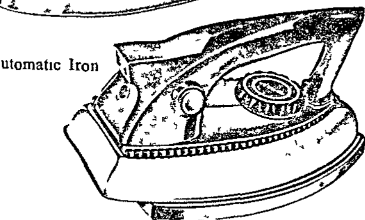

Pedestal Fan


Exhaust Fan

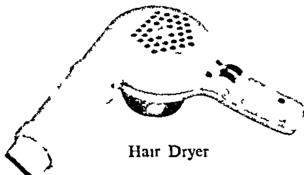

Table Fan



Electric Iron



utomatic Iron

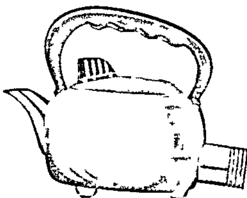


Hair Dryer

Electric Kettle

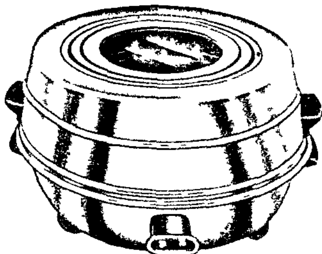


Water Immersion Rod

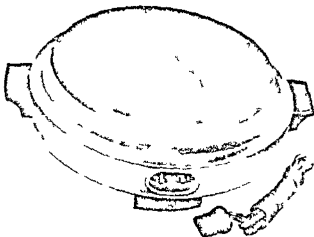


Auto Kettle

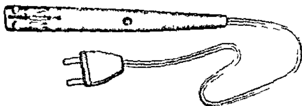
Milk Cooker



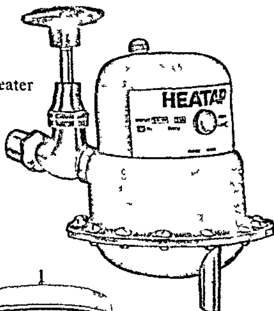
Electric Oven



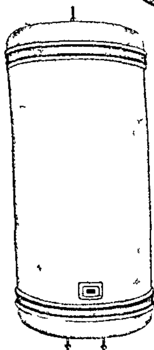
Single Hot Plate



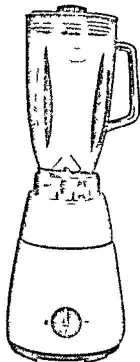
Electric Gas Lighter



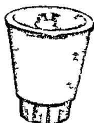

Water Heater

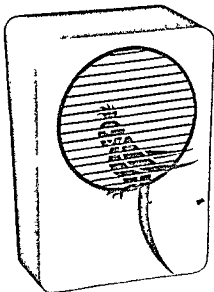


Geyser



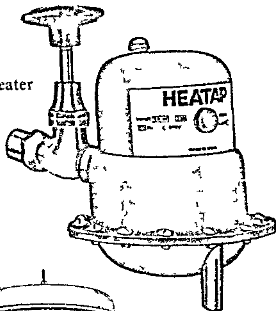
Electric Mixer

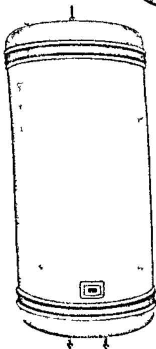




Electric Bell

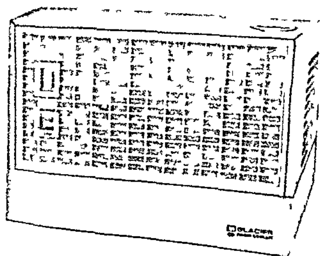
Water Heater



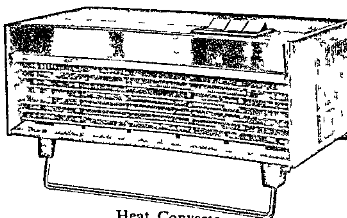
Geyser

Air Conditioner



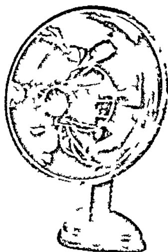
Room Cooler

Desert Cooler



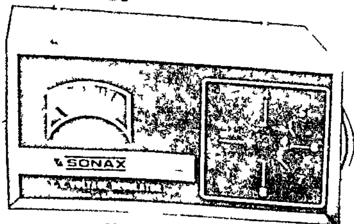
Heat Convector

Emergency Light

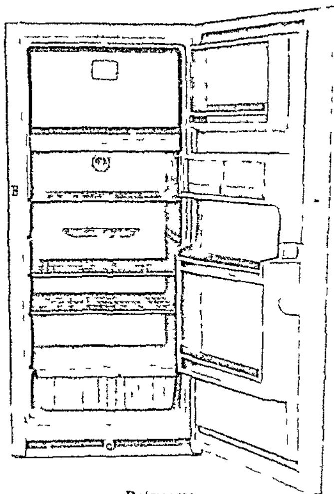


Room Heater

Washing Machine




Voltage Stabilizer



Refrigerator

# 14

# VOLTAGE STABILIZER

In India the industrial load agricultural load and general lighting load developed with the advancement of industrialization and technology very abruptly By load we mean wattage One thousand watts are called one kilowatt whereas 1000KW (kilowatts) are called one megawatt (1 000 000 watts) When this load is transmitted from a power house (through electric wires) to factories commercial establishments residences the voltage drops at the site of load as compared to that at the power house In short we can say that the voltage of electric supply at our residences is never constant and equal to 230 volts

If the voltage is constant and it is 230 there will be no trouble to our household electrical appliances But it is never constant Generally it is below 230 volts and after 9 00 P M it becomes even more than 230 volts

On every electrical appliance, the voltage and watt age is printed The voltage is always 230 volts A C or 250 volts D C In case of A C voltage only, the volt age can be regulated to near about 230 volts with the help of a voltage stabilizer It may be noted that the voltage above 250 can instantly damage our electrical appliances which are marked to work at 230 volts A C

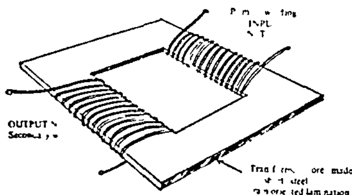
## PRINCIPLE

$$\frac{V_1}{V_2} = \frac{N_1}{N} = \frac{I}{I_1}$$

The design and operation of voltage stabilizer is based upon the above equation $V_1$ is the primary voltage $V_2$ is the secondary voltage $N_1$ is the primary number of turns N is the secondary number of turns $I_1$ is the primary current and I is the secondary current

From the above equation it is also indicated that voltage is proportional to the number of turns in a coil The more the number of turns the more is the voltage

A transformer consists of two windings called primary winding and secondary winding The electric supply leads are connected across the terminals of primary winding The out put is taken across the secondary winding If the number of turns of secondary windings are more as compared to primary winding the voltage at the out terminals of secondary winding will be more




Transformer

There are step up transformers which have only one winding These are called auto transformers The supply voltage is connected against part of the winding whereas the output is taken across full winding These auto transformers are utilized in the construction of voltage stabilizer

## CONSTRUCTION

In shape it is like a small box and is made of sheet metal Inside the box is housed a small auto transformer By transformer we mean an electrical appliance which transforms a lesser voltage into a higher voltage or vice versa Eight terminals are brought out from the transformer and are arranged in a circle A selector switch is provided in front of the sheet metal box This selector switch can be rotated clockwise or anticlockwise on figures marked from 1 to 8 At each figure one terminal from the transformer is connected underneath the metallic sheet At each figure the selector switch selects a particular voltage

This voltage can be read on a voltmeter fixed on one side of the selector switch There is a piano switch When this switch is turned on the voltmeter is connected in circuit and indicates the selector switch reading When the piano switch is in off position the voltmeter reading comes to zero and the voltmeter breaks out of the circuit At figure 3 the voltage indicated is the voltage being received from the electricity department If we move the selector switch anticlockwise towards 2 or 1 the voltage will fall If we move the selector switch clockwise the voltage will increase The voltage indicated on the voltmeter is that which appears across the three pin plug provided at the side or back of the voltage stabilizer

The type of voltage stabilizer explained il-

*led manually operated voltage stabilizer In case of an* automatic voltage stabilizer there is no selector switch The voltage in the three pin plug (output voltage) remains constant that is between 200 volts to 230 volts When the voltage from the electricity department (line voltage or mains voltage) falls control relay operates inside the voltage stabilizer housing and increases the voltage so as to vary between 200 to 230 Whenever the line voltage increases the relay again operates and bring down the voltage The piano switch is a double throw type In one position it indicates the voltage of the mains line and in the other position (down position) it indicates the voltage at the three pin plug (out put voltage)

## OPERATION

The three pin shoe of the voltage stabilizer is inserted in the three pin wall plug (house light plug) The pin shoe of the television air conditioner refrigerator or room cooler is inserted in the three pin plug of the voltage stabilizer Switch on the piano switch of the voltage stabilizer to find out the reading on the voltmeter Rotate the selector switch clockwise or anticlockwise to bring the voltage between 200 and 230 Switch off the piano switch You may note that switching on and switching off of the piano switch does *not effect the supply from three pin plug of the voltage* stabilizer This switch is provided to put on or put off the voltmeter

In case of a manually operated voltage stabilizer we have to check the voltage in the voltmeter off and on and adjust it if necessary by rotating the selector switch. As a normal practice check the voltage in the morning noon evening and before you go to bed In case of an automatic voltage stabilizer you are

saved from the botheration of checking the voltage off an on as adjustment of voltage takes place automatically

The voltage stabilizer must be provided to control the voltage to television casette/taperecorder, stereo, refrigerator air conditioner, mixer and room cooler etc

## FAULTS AND REPAIRS

Whenever the electric supply stops to the electrical appliance where a voltage stabilizer has been used first take out the three pin shoe from the main three pin plug (wall plug) Test the supply in the three pin plug with the help of a pen tester If the supply is available insert the three pin shoe of the voltage stabilizer Then test the supply at the three pin plug of the voltage stabilizer If the supply is available then the voltage is in order If not then check up connections in the three pin shoe of the voltage stabilizer and repair if the connections are open or burnt due to melting of wire ends insulation

*Broken Connections Inside the Voltage Stabilizer*

In case the supply is not available at the three pin plug of the voltage stabilizer when feeder wire three pin shoe and three pin wall plugs are in order then open the sheet metal box by unscrewing the body fixing screws After opening try to locate broken connections in the transformer or at the plug and repair such broken connections If the winding of the voltage transformer has been damaged (coil of wire wound around a thin metal sheet assembly) the voltage stabilizer can only be repaired by a professional mechanic (who will rewind the transformer)

The burnt winding can be detected from its smell

or from blackened insulation Whenever the winding of the transformer burns fumes or smoke comes out of the voltage stabilizer The burning of the winding takes place either due to aging or due to sudden high voltage surge on the electricity lines in the electricity department

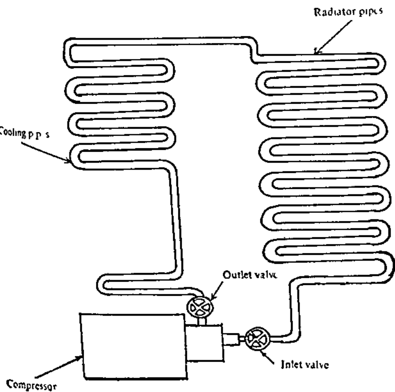
15

# REFRIGERATOR

Refrigerator is a domestic storing machine for your foodstuffs green vegetables and fruits It also provides a freezer which keeps the foodstuff cold In looks it appears like a steel cabinet or small almirah The inside temperature of the refrigerator is such that the foodstuffs green vegetables raw meat fruits vegetable dishes etc kept (stored) inside the refrigerator do not get spoiled when outside temperature is very high and would spoil eatables within a few hours The spoiling action of bacteria on cooked vegetables and other eatables is very fast due to heat in the atmosphere But this spoiling action is reduced to practically nil at temperature near zero degrees centigrade The outside temperature is hot in tropical countries like India and can touch degree 50/5 centicrade and even in cold countries like England Europe the temperature is quite appreciable during summer The refrigerator maintains its inside temperature near zero degrees centigrade The temperature inside the freezer (provided in the refrigerator) is even less than zero degrees centigrade

A freezer inside the refrigerator is still a smaller steel chamber Ice cubes or ice cream is made by placing trays of plain water or ice cream mixture inside the freezer

Refrigerator is a boon for the housewife She can




REFRIGERATOR

back of the refrigerator The gas by expanding in these tubes becomes cool again and is again pumped back into the freezer tubing through the motor In this way the cooling cycle goes on If you happen to touch the back side tubing or even the motor of the refrigerator during summers you would find them unberably hot

## OPERATION

When the refrigerator is to be put into its first service proceed as follows

1 Install the fridge at such a place in the room so that there is ample flow of air to keep the back tubing of the refrigerator cool

2 Put the regulator switch on figure 5 (cold)

3 Check the voltage of the stabilizer transformer (the function of voltage stabilizer transformer has been described in a saperate chapter on voltage stabilizers) Turn the selector switch of this voltage stabilizer so that the voltage is between 200 to 230

4 You may note that the three pin shoe of the voltage stabilizer is connected to the main supply whereas the three pin shoe of the refrigerator is connected to the voltage stabilizer plug

5 The switch of the voltmeter of voltage stabilizer is adjusted on position to note the voltage at which the electric supply is being fed to the refrigerator

6 Place a tray of ice cream mixture inside the freezer and close the shutter of the freezer and door of the refrigerator Switch on the refrigerator and note the time After two hours take out the tray The ice cream should be ready by now If the ice cream is ready or nearly ready your refrigerator is working perfectly

7 When the working of the fridge has been checked bring the knob of the refrigerator to number

3 Place your drinks fruits eatables etc in your newly brought refrigerator and enjoy the fruits of its conveniences

8 An automatic light bulb is provided inside the refrigerator This bulb is lighted when you open the door of the fridge and is put off when you close the door Actually a door switch is provided which puts off the bulb when pressed by closing the door and puts on the bulb when pressure is released from the door switch (when the door is opened) The inside light of the fridge helps to see your food stacked inside the fridge at night even if the room light is off

## MAINTENANCE

1 Check with the help of a test pen the body of the refrigerator and the body of voltage stabilizer that they do not show any leakage In case of leakage check connections of wires in the three pin shoes If the connections in three pin shoes are allright i e earth phase and neutral wires are joined correctly to the respective pins then call for the service man to check your refrigerator In case the leakage is in the voltage stabilizer, then get it set right from a repair shop You can repair minor faults of the voltage stabilizer yourself But do not fiddle with the machine

2 Keep outside body of the refrigerator neat and clean and shining Keep a small towel on the handle so that your unclean hands do not spoil the handle

3 There is a plastic tray placed below the freezer This collects water which falls when the ice melts from the tubing of the freezer Whenever this tray is filled with water it should be taken out and water thrown out There should be regular cleaning

4 Once a week switch off the refrigerator at night and take out all your foodstuffs In the morning you

will notice that the plastic tray will be filled with water Throw out this water and clean thoroughly the inside of the fridge with a clean cloth Cloth soaked in *Surf* can be used for cleaning Dry up water from the inside of the freezer also

5 Restart the refrigerator After it has worked for some time place your foodstuffs again in the stacks

Whenever you open the freezer note the formation of ice on the red spot If it is completely covered do not wait Put off the refrigerator for 12 hours as you do on any other day of cleaning

In the latest designs of refrigerators automatic defreeze is provided that is the refrigerator will switch off automatically when it is needed

6 In winter the regulator knob should be kept at number 1 and in severe winter the fridge should be switched off for few days or a month as the case may be

7 The room where you place your refrigerator should be normally cool i e no direct sun rays should fall in the room or on the refrigerator

8 There should be sufficient space between the backside of the fridge and the room wall to allow free circulation of air

## FAULTS AND REPAIRS

*Melting Insulation Wires*

If the size of the wire is not proper or there are loose connections in the three pin shoe the wire insulation will melt at the ends and will cause short circuit between neutral and phase wires In that case remove a two inch piece of wire from the end and reconnect again with the three pin shoe taking care that the green wire is connected to the earth pin

*Damaged Thermostat*

In case the electric supply to the refrigerator is in order that is the voltage reading is shown on the stabilizer transformer the wire from the voltage stabilizer to the fridge is in order and the light bulb in the refrigerator is lighted up when the door is opened but still cooling in the refrigerator does not take place it means the thermostat (relay) has been damaged This thermostat relay in fact carries electric supply to the refrigerator motor In case of thermostat being defective the motor will not get electric supply and thus will not start The cooling of the fridge will therefore stop In that case get a new thermostat relay and replace it While taking out the damaged relay note down the connections for making the same with the new one

*Leakage of Gas*

It may happen that even the motor works but the cooling still does not take place This is a case of leakage of cooling gas The leakage may be due to a broken gas tube anywhere behind the fridge or the tubing around the freezer This might have been damaged either due to aging or bad material or over freezing In case of gas leakage or damaged tubing services of a refrigerator mechanic will have to be obtained

*Damage to Motor*

In case the motor does not start even if everything is in order there is a possibility of motor being damaged As per guarantee clause the supplier of the refrigerator is required to replace the motor or repair it during the guarantee period Therefore you should approach the supplier for attending to the faults of sealed cooling unit the under guarantee clause

*Defect In Lighting*

The light can be defective either due to fused bulb or defedct in the door switch In case of fused bulb you can replace the bulb In case of damaged door switch this can also be changed Remove the wires from the door switch and join them together If the bulb is lighted when the refrigerator is on it means the defect is in the door switch If the door switch is al right and the bulb is also in order it means there is some defect in the light wiring

For mending wiring defect call for the services of a refrigerator mechanic

# 16

# ROOM COOLER (DESERT COOLER)

The commercial name of a room cooler is desert cooler During summer when hot air starts blowing ordinary fans cannot cool the room The circulation of air effected by an ordinary ceiling or table fan is that of the room air itself which is hot due to outside temperature The room cooler on the other hand cools the air before it blows it into the room This cool air replaces the hot air of the room and by and by the room becomes cool The air blowing into the room from the room cooler is cool and refreshing

## PRINCIPLE AND CONSTRUCTION

When water evaporates from a surface of any material body it renders it cool The same principle is utilized in the working of a room cooler (desert cooler)

The blower in the room cooler is coupled with a water lift pump When the blower revolves it lifts water from the tank of the cooler and flows it into the ducts from where the water sprinkles over the wood packing placed at the side and back of the room cooler The blower sucks the air through these wood wool packings The water then evaporates on to the wool packing making it cold The air which is drawn through this wood wool packing and blown into the room with the help of a blower becomes quite cold

The appearance of a room cooler is box type The sides and the back are perforated The back side plate is detachable Wood wool packings are placed against the perforations In the bottom six inch portion there are no perforations on any side and is used as the tank for housing water

Inside the room cooler is fixed a motor On this motor is attached a special type of fan blower and a lift pump The pump lifts the water from the tank and drops it in the slots provided at the top from where the water trickles down the wood packings making them wet The design of the fan is such that it sucks air from the back and sides and blows it into the room from the front

On the front side of the room cooler most of the portion is open to allow easy passage of air A plastic decoration type grille and louvres are provided in the front The hot air when it is drawn through the wet wood wool packings become cool and humid The room cooler is generally fixed in a window so that its back and sides are open to the outside air for easy suction

## OPERATION

1 Fill water in the tank so that indicator in front of the room cooler indicates water level full

2 Put the humidity control switch (provided on the top of the cooler) to cool position This humidity control switch is called Aquadial The other extreme position of this switch is Vent At vent no water will flow on to the wood packings and only dry air will be blown into the room Aquadial switch is kept on vent position during rainy season This switch is put at mid position at night when the outside air (during summer) becomes comparatively cool

3 Insert the three pin shoe in the three pin wall plug Switch on the wall switch Put the Off and On' switch provided in front of the cooler panel in any position *low* *medium* or *high* depending upon the individual requirement

4 When you want to switch off the cooler first switch off from the panel switch of the room cooler and then switch off the wall switch

## MAINTFNANCE

1 Whenever the cooler starts blowing hot air observe the water level on the indicator You will find it to be empty For filling water in the cooler switch off the cool r I et the motor stop and then fill fresh water

2 Preferably fix the room cooler in a window If you want to keep it portable then keep it near the window(back towards the window) so that it can draw fresh air from outside

3 Check connections in the three pin shoe so that the earth wire (green in colour) is connected to the earth pin

4 Check off and on with the help of a test pen for any current leakage in the body of the room cooler

## FAULTS AND REPAIRS

1 Broken connections in the three pin shoe or at the cooler terminals

2 Loose connections and damaged insulation of wires at the ends (near the three pin shoe)

3 Damaged Off and On switch of the room cooler

4 Damaged motor condenser

5 Damaged motor

6 No cooling

# 17

# ELECTRIC MIXER

Electric mixer is a boon for a housewife It is a very useful kitchen appliance for grinding spices, onions garlic and ginger It is both time and energy saving

Another use of this mixer is in the preparation of fruit juices milk shakes cold coffee etc

## PRINCIPLE AND CONSTRUCTION

The force of impact is more at high speed This principle is utilized in the construction of guns The more the speed the more piercing effect the bullet has This principle is also utilized in the construction of mixers The grinder revolves at a very high speed and crushes even salt stones to fine powder

The mixers come in three sizes viz small medium and large The small and medium sizes are for house hold purposes whereas the large size is used for commercial purposes The small size has only one speed and there are no control switches at the bottom

The electric mixer can be divided into three parts from construction point of view

*Base*

The base portion houses a small electric motor of a fraction horse power Piano type off/on and speed control switches are provided at the base Besides

off / on' position the other positions are medium and fast A small mixer is provided with only one speed

*Grinder and Blender*

The grinders are of two types The one required for preparing fruit juice vegetable onion masala and milk/fruit shakes has original steel blades and is called blender For grinding dry spices and hard mixes the blades of the grinder are small in size and are made of very hard stainless steel

*Glass Bowl*

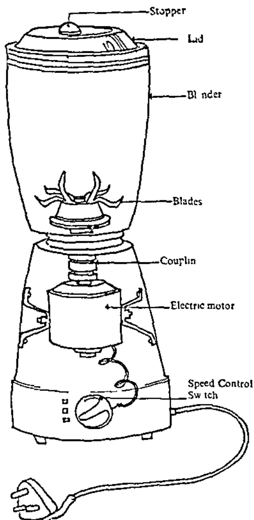
The glass bowl surrounding the grinder is provided with a lid The material to be grinded or mixed is put into this bowl After the preparation is ready this bowl along with the grinder is detached from the shaft of the motor The contents are then poured out

## OPERATION

The desired grinder is fitted with the motor The motor shaft which carries a plastic gear arrangement fits tightly into the grooves provided underneath the bowl The contents are poured into the glass bowl to ¾ capacity The three pin shoe of the mixer cable is inserted into the plug of a portable switch board If the mixer is single speed the switching off /'on is done from the portable switch board

## MAINTENANCE

1 The motor of the mixer is not continuously rated It should be stopped after 1 to 2 minutes in case of preparation of juices or preparations like milk shakes In case of grinding spices it should be stopped after five minutes and the condition of contents checked




ELECTRIC MIXER

2 While preparing juices or wet masala for the vegetables, the contents should be peeled off and cut into 1/2 to 1 inch sizes For grinding the ingredients should be broken to pea size and dried or roasted

3 If the mixer stops due to some defect it should be immediately stopped and the cause of defect checked

4 After the grinding or preparation of juices the mixer bowl and grinder should be flushed with water and cleaned with dry cloth

## FAULTS AND REPAIRS

1 Broken connections in the three pin shoe or in the terminal box at the foot of the mixer

2 Defect in the rotating plastic gear arrangement

3 Defect in the piano control switches

4 Defective motor bearing

5 Defect in the mixer motor

The first defect can be repaired easily

In case of defective rotating parts look for broken teeth if any If so the gear with broken teeth should be replaced In case of jammed gears dismantle the gears and locate the defect

In case of defect in piano switches the main defect can be a broken connection which can be repaired In case of the mechanism of piano switch having become defective the piano switch should be replaced

Since the speed of the mixer motor is very high the bearing can be damaged after long use The damaged bearing starts giving cracking noise Such a bearing should be replaced

If the winding of the motor has been damaged then have it repaired from a mechanic Before declaring a motor damaged look for all the possible causes of faults one by one

# 18

# GEYSER

It is a double walled cylinderical vessel white enamel coated from outside It is fitted with a tubular heating element of 1000 to 5000 watts rating The geyser is fitted on the wall of a bathroom at a suitable height Cold water enters through one inlet pipe and comes out through another outlet pipe The inlet and outlet pipes are controlled with the help of stop cocks Terminals for heating rod are brought out at the base A red electrical indicator is provided on the geyser which glows when the electric supply to the geyser is on

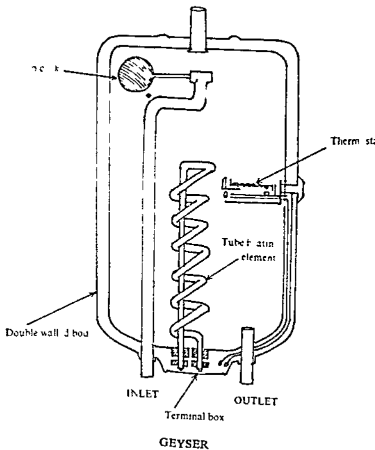
The geysers are of three types

**Storage Water Heaters**

The vertical models (which are fixed head up bottom down) are of 20 lit 25 lit 35 lit 50 lit 70 lit and 100 lit capacity The horizontal models have a capacity of 25 lit 30 lit and 50 lit These are either fixed horizontally on the wall or can be mounted on the floor The outlets can be one or more than one depending upon the size of geyser

**Portable Geysers**

The water capacity is about 15 litres The rating of heating element is 3000 watts There is only one hotwater outlet




GEYSER

**Instant Water Heater**

This geyser is either electronic (without a normal heater element or is provided with a heating element of 1300 watts to 1600 watts rating It is fitted either at the tap point or at the shower point

## CONSTRUCTION

The inner container is made of heavy gauze copper sheet coated with tin on either side and the outer container is pre treated against corrosion with super enamel finish A thick layer of glass wool is provided between the inner container and outer container to effect thermos action (no h-at from inside can radiate to outside cold atmosphere)

There is an automatic thermostat temperature control (the heating element will be switched off near boiling temperature) However an arrangement is made so that the electric supply to the water heater discontinues when there is no flow of water into the water heater

## OPERATION

In case of storage water heaters open the control valve to the inlet pipe and keep the outlet control closed This will fill the geyser with cold water Switch on the electric supply The indicator lamp will start glowing When the water in the geyser is heated to nearly boiling temperature the thermostat control will automatically cut off electric supply to the geyser The indicator at this temperature will also stop glowing Now open the outlet control valve to drain hot water In case of portable and instant water heaters both inlet and outlet valves are kept open The flow at inlet is controlled to have outlet water at desired temperature (in case the temperature of outgoing

water is low decrease the supply of water at inlet and vice versa)

## MAINTENANCE

1 Before electric supply to the geyser is switched on ensure that the inlet water supply valve is open to the geyser

2 *In case of instant water heaters avoid using hard* water as this water contains mineral salts

3 In case of leakage of current in the water taps check for connections of earth wire in the three pin shoe and at the terminal plate of geyser Also check for broken insulation at terminal plate

4 The feeder wire should be of proper size and of copper

## FAULTS AND REPAIRS

1 Broken connections in the three pin shoe or at terminal box or terminal plate

2 Damage to the wire insulation at ends

3 Damage to the wire insulation in its entire length

4 Damaged heating element

5 Damaged thermostat

The first three defects can be removed easily as for any other electrical gadget

The damaged thermostat can also be replaced The heating element is the last item to be damaged In case of damaged heating element it is better to get the geyser repaired from a professional electrician

# 19

# WASHING MACHINE

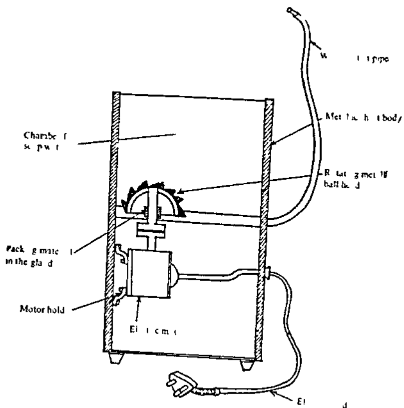
Washing machine is becoming very popular with all middle class families and particularly in families where both husband and wife are working It makes the washing easy and economical Further you are saved from the botheration and delays at the cost of a *dhobi*

## CONSTRUCTION AND PRINCIPLE

The washing machine is fitted with an electric motor of 1/4 horse power To the shaft of this motor is coupled a metallic hollow ball having small ridges on it The shaft is passed through a water tight gland so that no soap water can leak through the soap water housing and fall on to the electric motor

The motor is not visible and is housed in the lower portion of the washing machine The upper half portion is either square in shape or round in shape Head of the round metallic ball emerges into this hollow portion The soap water or *Surf* water are put into this portion along with clothes for washing A hose pipe is provided to drain out the dirty soap water after the clothes have been washed and wrinsed A provision is made and attached to the washing machine for wringing the clothes

The principle of centrifugal force is utilized in the construction of washing machine A metallic hollow ball having small ridges on its surface is coupled to




WASHING MACHINE

than fifteen minutes Thus you must change the lot of clothes and the machine will get rest automatically

2 When the motor stops rotating even though both the switches are on immediately switch off the machine and remove the clothes The stopping of the motor may either be due to over loading of rotating ball with clothes or some button or cloth might have got stuck with the ball or in its grooves Remove such clothes or buttons very carefully by rotating the ball in reverse direction by hand This will loosen the stuck in garment and you should remove the cloth slowly to avoid its tear

3 While working with the machine check the body of the machine with a test pen off and on so that it does not show any leakage of current and a resultant electric shock on touching

4 It the motor is jammed due to some unknown cause do not keep the motor on It will burn the motor

5 If the motor gives some cracking or unhealthy sound immediately stop the machine and try to find out the cause of the alarming sound

6 Do not use the machine when the voltage of your house falls below 200 volts due to fluctuation on the electric lines of the electricity department At low voltage your house fuse will not blow out and there is no safety provided against low voltage At low voltage the motor gets damaged

### FAULTS AND REPAIRS

1 A broken connection in the three pin shoe or at the terminals of the motor of washing machine

2 Wrong connection of earth wire

3 Sticking of rotating metallic ball

4 Defect in the body switch of the machine

5 Defect in the electric motor

The first two defects are minor and can be repaired easily as already explained Even defective switch can be repaired easily or changed if broken

Regarding sticking of rotating ball locate visually if any thread piece of cloth or broken buttons have slipped into the groove If nothing of the kind is noticed, try to rotate the ball by hand If the ball does not rotate it means the packing material in the gland has been damaged You can try but it is a bit difficult to replace the packing material yourself So ask for an electrician s assistance

Defect in motor should be traced out whether the fault is minor i e broken connections of the winding This can be found out by opening up the motor For repairing the motor the motor should be removed from the washing machine The motor should then be opened Broken wires can be repaired easily If the motor winding coils have been damaged take out the burnt coil and get a new one of same sized wire and of same weight/number of turns Then put this coil in the motor and make the necessary connections

Grease should be given to the rotating parts of the motor regularly and periodically to provide smooth running of the machine and prevent its rusting

*Caution*

Do not wash very thin or embroidered and silk sarees in the machine as they are likely to be damaged by the rotating ball

## 20

# AIR CONDITIONER

An air conditioner is an appliance which keeps the room temperature pleasant both during summer and winter Besides keeping the temperature of room controlled it does not affect the normal humidity of the room During summers you can enjoy the temperature of a hill station in your room with the help of an air conditioner and during winters your room is warm and pleasant The temperature can be controlled to suit your personal requirement

### PRINCIPLE AND CONSTRUCTION

The principle of refrigeration is utilized in the working of an air conditioner The only addition is the blower which sucks in hot air of the room through one set and blows in cold air through another set of ducts/louvers The air sucked in from the room passes over the cooling pipe assembly and becomes quite cold before it is blown into the room

The air conditioner is a box type construction consisting of three major units and can be divided into following parts

*Cooling Unit*

The cooling unit consists of a compressor and sets of cooling tubes The cooling gas is compressed in the compressor and in liquid form it is sent into cooling

tubes placed around the blower The gas in these tubes expands and bring down the temperature on these tubes to sub zero The gas after cooling these tubes is drawn into another set of tubing placed at the back of the air conditioner Water trickles on this set of tubing and cools the gas (which had become hot after shedding coolness in the first set of tubing) This gas is again drawn into the compressor It is again compressed to liquid form and pumped into the first set of cooling tubes Thus the cycle of cooling gas goes on

*Blower*

The blower (a type of fan) is designed to suck air of the room from the front grille and blow it out after cooling it into the room from the top louvers

*Water Tank*

A water tank (small in width) is provided at the top of the air conditioner The water from this tank trickles on the back set of tubing and cools the gas Once filled the water is sufficient for eight hours

*Controls*

*Exhaust* If you open the exhaust the polluted air from the room can be exhausted to the outside atmosphere

*Ventilate* If you open the ventilate fresh air from outside can be drawn into the room

*'Off and On Switches*

The 'Off and On switches have *on off fan* and *cool* positions At *fan* position blower starts working At *cool* position both blower and cooling units are working

*Thermostat*

Thermostat control at heater will work only as heater whereas at other positions it works the air conditioner for cooling At *cool* it is maximum cold The other positions are for lesser cold The thermostat control is an automatic control for room temperature When the room temperature comes to a set temperature of the thermostat the air conditioner automatically stops

## OPERATION

1 Insert the three pin shoe of the feeder cable into the three pin wall plug

2 Fill the tank with water

3 Switch on the wall plug

4 Rotate the control knob to *cool* position The air conditioner will start working

5 Rotate the thermostat knob to cooler position

6 The blower sucks air from the room through grill and blows into the room through louvers The air after passing over the cooling tubes become cool

## FAULTS AND REPAIRS

1 Broken connections in the three pin shoe or at the terminal ends of the air conditioner

2 Damage to insulation at the ends of the feeder cable

3 Damage to the blower

4 Damage to the compressor

5 Leakage of cooling gas

6 Damage to the heating elements

In case of first fault the air conditioner will not get electric supply and will not work even if the control knob is rotated to cool position or heating position Open the cover of the three pin shoe and

look for any broken connections Also check up for broken connections at the air conditioning terminals

In case of damaged insulation at the ends of the feeder cable cut out a two inch piece from the ends and make fresh connections

If no air blows out of the air conditioner when it has been switched on check for any damage to the blower It can either be a broken connection to the blower (which can be repaired easily) or the motor of the blower might have been damaged Get it repaired

In case of damage to the cooling unit the com pressor motor will not work and no cooling will be produced Check up if it is the motor which does not work In case of damaged motor get the repair done from the air conditioner repair shop or from the supplier in case the damage to the cooling motor has taken place within the guarantee period

In case the cooling gas has leaked due to damage to the cooling tubes the damage to the cooling tubes should be repaired and cooling gas refilled from air conditioner repair shop The cooling in this case will not take place even if the compressor motor works properly

In case of damage to the heating elements no heating will be effected by the air conditioner in winter season A damaged heating element should be replaced The leakage of electric current in the body of the air conditioner can be checked with the help of a test pen If there is any leakage check up from broken insulation of electric wires in the air condi tioner

## MAINTENANCE

1 The connection of earth wire in the three pin

shoe should be proper

2 Ensure presence of cooling water in the water tank every morning

3 The feeder cable size should be proper

4 The room where the air conditioner is installed should have air tight doors windows and ventilators The doors should be provided with automatic shutters The number of open doors windows and ventilators should be as less as possible

5 The air conditioner is always fitted in the wall so that the front is open into the room and whole of back body protrudes out to dissipate heat to the outside atmosphere

6 Automatic voltage stabilizer must be used with the air conditioner as a safeguard against fluctuating voltage of electricity

## 21

# ELECTRIC BELL

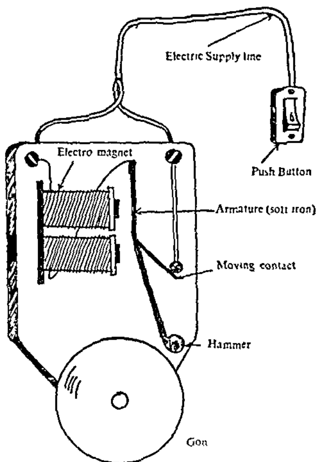
### CONSTRUCTION

An electric bell consists of a small electromagnet There is a moving contact (moving arm) This moving contact carries a small metallic ball point which strikes against a gong (Metallic semi circular attach ment) When an electric current is passed through the coil of an electromagnet the magnet attracts the moving arm and its point strikes against the gong When the arm moves towards the electromagnet the connection of electric supply is broken and the arm goes back to its original position In doing so the connections of electric supply are again made and electromagnet again attracts the moving arm Thus to and fro movement of moving arm causes striking on the gong

The components of an electric bell are illustrated in the diagram The magnetic coil is wound with a thin copper wire

### OPERATION

When the push button of the bell is pressed at the gate or in the verandah an electric current is passed through the coil and the electromagnet attracts the moving arm towards it When this arm moves towards the magnet the electric circuit is broken and the electric supply to the magnet ceases The electro




ELECTRIC BELL

4 In case the ball point is found touching the metallic gong on inspection the bell in that case will not sound and the adjustment screw in that case should be moved out

5 In case of damaged (burnt) electromagnet coil the bell will not work Such a coil needs replacement The burnt coil can be detected from its smoky condition or from its smell

## 22

# HEAT CONVECTOR

A new development in plate heaters/foot heaters is the Sunflo The housing of this heater consists of a heating element and a small fan to blow out heat from this heating element In other words the air which comes out of this heater is hot and makes the room warm Just like a desert cooler for summer it is a room heater for winter

### CONSTRUCTION

As shown in the figure (page 125) it has a box type construction (the width being quite small as compared to other dimensions) The control switch has four positions Off I II and Fan At position I one heating element is switched on along with the fan On position II two heating elements are switched on along with the fan At position off only the heating element works and the fan stops At fan position only fan works and the heaters are off

### OPERATION

Insert the three pin shoe in the wall plug Switch on the wall plug Rotate the control knob of Sunflo to position I or II keeping in view the intensity of heat required and the size of the room

### MAINTENANCE

1 The feeder cable size should be at least 6 mm alumi

mium or 5/22 copper The insulation of the undersized cable (if used) will be damaged on 2000 W load

2 The earth wire connection in the three pin shoe should be proper (green colour wire should be connected to the thicker pin of the shoe)

3 The body of the Sunflo should be checked periodically with the help of a test pen for any leakage

## FAULTS AND REPAIRS

1 Broken connections in the three pin shoe or at the terminal points of Sunflo

2 Melted wire ends

3 Damaged fan

4 Defect in the control switch

5 Current leakage

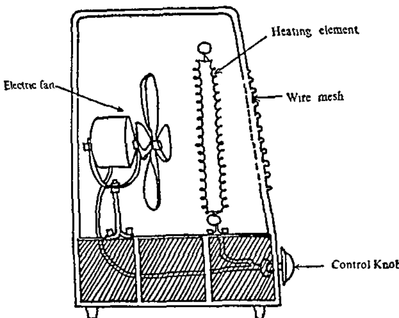
In case of broken connections the electric supply to the Sunflo will stop and neither the heaters nor the fan will work Check up for broken connections in the three pin shoe or at the terminals of Sunflo Repair the broken connections

In case of melted wire ends the phase and neutral wires when in contact cause a short circuit and the insulation at the ends of wires melts This in turn will blow out the house fuse whenever the Sunflo is switched on For this fault look for damaged insulation of wires either in the three pin shoe or at the terminals of the Sunflo In case of damaged insulation cut the feeder wire by two inches at the ends and make fresh connections In case the insulation of whole feeder cable has been damaged replace the feeder cable

If either one or both the heating elements have been effected you can automatically know that fan is damaged The fan no doubt will work but the air coming from the Sunflo will be either cold or less hot The damaged heating element can be located by dismantling the Sun

flo and inspecting the heating elements The damaged heating element has to be replaced

In case of damage to the fan it will not work and no hot air will flow out of the Sunflo The fan will not




Heat Convector

work even if the Sunflo is switched on If it is a broken wire connection to the fan it can be repaired easily But in case of damaged fan motor it will have to be repaired by an electrician or the fan may be replaced as a whole

In case of defective control switch the Sunflo will not work If it is a loose contact between the moving arm and the fixed contacts this can be repaired by bending the contact arm strip The fixed and moving contacts

should be cleaned thoroughly with the help of petrol In case of a burnt control switch and burnt contacts the control switch should be replaced

In case of leakage of current into the body of the Sunflo look for bare wire (feeder wire) coming in contact with the metallic body of Sunflo or broken insulation between the heating element and the body of the Sunflo

## 23

# COOKING RANGE

An oven when fitted with heating plates is called a cooking range The number of plates vary from two to three The heating plate is in the shape of a tubular heating coil Additional controls for these heating plates are also provided

The shape of cooking range resembles that of an ordinary cabinet type electric oven At the top of this cabinet (on table top) are provided two or three heating plates

In short in a cooking range there is provision for keeping cooked foodstuffs hot provision for baking and also provision for cooking meals on the hot plates

The heating elements both inside the oven and that of hot plates are called heating tubes which are quite tough and have a long life

### OPERATION

To open and close the door pull gently and push the door knob gently to close

At the back is an exhaust hole Keep it initially open for about 5 to 7 minutes so that moisture can escape Then keep it closed till the duration of the cooking

Switch D in the cooking range is used for controlling the radiant hot plate on right hand side

Switch C is meant for controlling the radiant hot

plate on left hand side

The respective positions for these switches means

When on 0 OFF

When on 1 LOW (Low heat) 300 watts

When on 2 Medium (Only one coil working) 600 watts

When on 3 High (High Heat) 1250 watts

Switch B is a thermostat switch which regulates automatically the temperature of oven chamber as required in the range of 50 C to 300 C (120 F to 570 F)

Pilot Lamp is for oven only The oven switches On and Off according to the inside temperature reached and the pilot lamp lets you know it by its On and Off

Switch A is for controlling the heating elements *in the oven The switch positions denote the following*

When on 0—OFF

When on 1—Both top and bottom elements working

LOW —Low heat (300 watts)

When on 2—Only top element working medium heat

Medium —Grill (600 watts)

When on 3—Both top and bottom elements work ing

High —High heat (1200 watts)

## FAULTS AND REPAIRS

The general faults and their repairs could be followed as outlined in the chapters on heating plates and ovens

# 24

# BATTERY ELIMINATOR

Transistor radios portable record players and stereos portable television sets and tape recorders are battery operated By adding to the cost of above gadgets an in built arrangement is provided so that these sets can be operated on A C mains also When the A C supply cord is plugged in the battery of the set is isolated

The consumption cost of batteries is quite high as compared to the electric consumption charges If the sets do not have an in built arrangement for operating them on the A C mains battery eliminators can be made use of The battery eliminator is connected to the A C mains through a suitable electric cord The transistor radio record player tape recorder or any such equipment is connected to the battery eliminator at the indicated plug (output D C )

## CONSTRUCTION

The battery eliminator houses a small step down transformer and a semi conductor rectifier circuit The transformer steps down the A C voltage from 230 to 6 volts or 12 volts This 6 or 12 volts A C is then converted into 6 or 12 D C volts by passing it through the rectifier circuit A red indicator is provided which starts glowing when the eliminator is connected to the A C supply A flush type switch is provided to switch On Off the D C supply to your set So that no confu

sion takes place while making connections with the battery eliminator at the input socket it is mentioned 230 volts A C and at the output socket—6 volts or 12 volts D C

## FAULTS AND REPAIRS

Battery eliminator is quite a compact and robust *equipment The transformer and the rectifier circuits* are very rarely damaged The damage to the transformer is only apprehended when there is accidental rise of A C mains voltage The battery eliminator in that case will give out smoke The repair to the transformer or to the rectifier circuit should be entrusted to a mechanic The other faults which can be attended easily are loose connections at the plug or shoe broken connections at the plug or at the socket of the battery eliminator

## 25

# VACUUM CLEANER

The cleaning of your house with the help of a vacuum cleaner is most scientific and hygienic In ordinary sweeping dust particles are spread into the air of the room These dust particles are thus inhaled and cause sore throat and infection in the respiratory system Further these dust particles after floating in the air for some time again settle down on your furniture and other articles of your room and make them look unclean In case of a vacuum cleaner no such nuisance takes place The dust is sucked through a flexible pipe and dropped into a plastic bag through the pipe

## CONSTRUCTION

The vacuum cleaner equipment consists of a rotary pump which is worked with a small high speed electric motor There is one inlet and one outlet to this rotary pump At the inlet a long flexible pipe is connected ending into a broad mouth The outlet of the rotary pump is connected to a flexible bag (which is detachable) through a small pipe

The pump and motor are housed in a sheet of metallic casing Rotary pump is in fact a vacuum pump From the inlet pipe dust is sucked in From the outer pipe this goes into the plastic bag The suction is so strong that even pieces of stone paper wood and other foreign material are easily picked up and the sur-

face of the carpet (where vacuum cleaner is being used) is rendered clean The long inlet pipe helps in not moving the pump trolley too much in the room

The outlet bag after cleaning the room can be detached and the dust material spilled out The empty bag can be again attached to the outlet pipe and the vacuum cleaner is ready for use again

## FAULTS AND REPAIRS

Loose or broken connections in the three pin shoe or at the terminal box of the vacuum cleaner is the first possibility for non working of the vacuum cleaner The three pin shoe (plug) and terminal box at the vacuum cleaner should be opened and necessary repair should be carried out

In case the end insulation of the electric cord has been damaged or the wire ends have melted cut out a two inch piece from the ends and make fresh connections

*Damaged Motor*

In case the electric supply is in order and the electric cord is in sound condition but the vacuum cleaner does not work the cause may be a damaged motor In that case the vacuum cleaner will have to be dismantled Find out if it is a mere broken connections at the motor terminals Smell the winding of the motor If it gives smell of burnt material the motor should be repaired by an electrician or it should be given to the electrical goods shop for repair

*Puncture in the Suction Pipe*

If the suction pipe is punctured due to mechanical fault the working of the vacuum cleaner will become very much inefficient Proper suction will not take

place in the pipe and dust material will thus not be lifted The punctured suction pipe should be replaced as a whole

*Defective Rotary Pump*

Number of faults can take place in the rotary pump such as damage to the bearings loose packing material in the gland The faulty pump should be immediately repaired by an electrician

*Jamming of the Pump Bearings with Dust*

To keep the vacuum cleaner in the best condition it should be thoroughly cleaned from inside once a month

## 26

## EMERGENCY LIGHT

Whenever the electric supply fails everybody in the house feels panicky and a frantic search is made for a match box and a candle to light up the room Sometimes the candle may not be available and one has to sit in the dark till the electric supply is restored

In commercial establishments and operation theatres the failure of electric supply may result in theft or danger to human life To ward off this situation emergency light has been developed The model of this light is shown in the pictorial view

### CONSTRUCTION

An emergency light is a double element vacuum coated beam with replaceable bulbs It has switches for dim and bright light to suit one s requirement

In addition it has testing push button pilot lamp and extension socket self regulating and self controlling battery charging system of 6 V battery Once lighted an emergency light works for 2½ hours in continuous operation

### OPERATION

Connect the unit to 230 V A C mains supply The pilot lamp will glow indicating that the unit has been connected to the supply When switched on, the battery

circuit gives light

Test switch has been provided to test the unit When the test switch is pressed the battery circuit will be connected and a red indication light will be on

## MAINTENANCE

1 Place the unit in the position as shown by the arrow mark on the label *Do not tilt the unit* as this will cause the battery acid to leak

2 Do not connect the unit to mains unless the red and black wires inside the unit have been connected to positive and negative terminals of the battery respectively

3 After connecting the leads to the battery apply vaseline to avoid corrosion of the terminals

4 After every two weeks add distilled water in all the three compartments (cells) of the battery to maintain the acid level

5 *The unit should not be left idle for more* than a week It should be connected to A C mains at least for 5 to 6 hours a week keeping it in On position

6 When the unit is not required for use during holidays keep the emergency light in Off position and disconnect it from A C mains

# ELECTRIC GAS LIGHTER

In order to light the gas and to avoid the use of match box electric lighter is being used by house wives It is economical and safer as compared to conventional use of match sticks for lighting gas ovens and gas stoves Match box becomes damp and inoperative during rainy season burnt out match sticks often dirty the kitchen and there are also chances of burning the fingers All these could be avoided with the electric gas lighter in your kitchen

## CONSTRUCTION

The body of this pen like gas lighter is made of flame resistant butrate resin The cap of the lighter is protected by an anodized aluminium grille

A push button is provided on the body Press this button gently for switching on the lighter Bring the lighter close to the stove Leave the button almost immediately Under no circumstances should the lighter remain lighted for more than about five seconds Rated at 230 volts this lighter is suitable for operation on A C supply only

## MAINTENANCE

1 Avoid contact with the cap of the lighter while it is in operation

2 Avoid handling the lighter with wet or oily hands

# 28

# HAIR DRIER

This is very handy equipment for ladies for drying and setting their hair contours The ladies hair dressers also make use of this while giving artificial curls to the hair During rainy reason or in winters the hair drier shall dry up hair fast if one is in hurry

## CONSTRUCTION

Hair drier primarily consists of a small fan and a small heating element The air from the fan blows over the heating element and becomes hot Provision is made to have independent switch control for heating element The heating element can be switched off when not required A three pin shoe is connected at one end of the electric cord (cable) whereas the other end of the cord is connected to the hair drier

The heating element and the blower fan are housed in an unbreakable bakelite body The shape of the hair drier is horn type and it has an easy hand grip The whole equipment is quite light and easy to handle

## FAULTS AND REPAIRS

1 If the connections in the three pin shoe are broken or loose the working of the hair drier will be impaired The three pin shoe should be opened and necessary repairs should be carried out

2 If the heating elements is damaged the fan will work but the air blown out will not be hot Open the hair drier and find out if the heating element is damaged or there is a break in connections If the heating element is damaged it should be replaced with an exact duplicate which can be bought from the market by showing the damaged one If the connections have been snapped they should be rectified

3 In case the fan has been damaged no air will blow out of the hair drier Open the hair drier and check the connections of the wires and also smell the fan motor If the connections are broken the fault can be removed by repairing the connections In case the fan motor gives some burnt smell and does not rotate it needs replacement An exact duplicate drier fan should be purchased from the market by showing the damaged one and immediately replaced

4 In case insulation of the electric cord has been damaged at the ends fresh connections should be made after cutting a two inch piece from the ends

29

# MILK COOKER

Crying over spilt milk is a saying that many house wives have often taken literally For unless the milk is watched while on stove or gas it boils over and spills

To overcome this hazard a milk cooker has been introduced Generally the milk cookers are heated externally by a gas oven or electric heater But milk cookers with embedded electric heating elements are also available It is provided with an automatic whistle which gives a prompt and timely warning as and when the milk starts boiling The sharp whistle never fails to alarm the housewife The milk cooker can be easily stored in a refrigerator

## OPERATION

While using the milk cooker keep these in mind

1 Remove the stopper on the whistle and fill the outer chamber with about one full glass of water

2 Replace the stopper and pour the milk into the inner container

3 Cover with the lid and place in an oven or as a heater (for external heating) You will hear the whistle blow when the milk boils

## MAINTENANCE

1 Always pour water in the outer chamber before

issued to the manufacturers for their products by the Indian Standards Institution itself The manufacturer who wants to get ISI mark for his product is required to submit five samples of his product to the Indian Standards Institution These are tested by the Indian Standards Institution for their standards of quality Then an Inspecting Officer of the Institution visits the factory premises of the applicant and selects samples at random These samples are also quality tested A few samples are also collected from the market They are also quality tested If the Institution is satisfied with the overall test results an ISI mark is issued to the manufacturer for his product Then that manufacturer can stamp on his product the ISI mark

After every six months the samples at random are taken from the factory premises of the manufacturers and quality tested so as to ensure that the quality of the product is not reduced by the manufacturers with the passage of time and they misuse the ISI mark and fool the customers It is ensured that ISI mark is a guide to the customers for selecting products of best quality If the customer has a complaint against some ISI approved product he can also write to the ISI authorities

## CONSUMERS GUIDE

In the manufacture of Electrical Household Appliances Bajaj Racold Johnson have a big name In the manufacturing of light fittings and lighting items electric fans and motors Philips Cromption G E C Sylvania have an equally reputed name In the manufacture of certain items such as electric fans electric irons electric heaters washing machines electric kettles some local manufacturers have also come up

If they use the best raw material and ensure the quality control the items manufactured by them (which are comparably quite cheap) can also serve your purpose But there is no certificate of quality and guarantee about such locally manufactured items and sometimes they can miserably fail and even endanger your life while in use if proper quality insulating material has not been used in their manufacture For the guidance of the consumer a table is given below As a principle go in for the best material even though at the face of it it may appear a bit costly

| | *Name of the item* | *Manufacturer s name* |
|---|---|---|
| 1 | Screw Driver Set | PYE Gedore |
| 2 | Pliers and Cutters | Gedore |
| 3 | Spanners Set | Gedore |
| 4 | Test Pen | Amarjyoti Meena Philips |
| 5 | Black tape | Hillion |
| 6 | PVC tape | Steel Grip |
| 7 | There Pin and Two Pin Plugs | Bajaj Kay Veto AMCO |
| 8 | Three Pin and Two Pin Sockets | Bajaj Kay Veto |
| 9 | Switches | Bajaj Kay Veto |
| 10 | Electric Lamp | Philips Crompton Bajaj Sylvania GEC Keselec |
| 11 | Flourescent Tube | Philips Crompton Bajaj Sylvania GEC Keselec |
| 12 | Starter | Philips Crompton Bajaj Sylvania GEC Keselec |
| 13 | Choke | Philips Crompton Bajaj Sylvania GEC Keselec |
| 14 | Electric Fans | Crompton Usha Bajaj GEC Orient Rallifan |

| | | |
|---|---|---|
| 15 | Electric Heaters | Bajaj Racold |
| 16 | Electric Press | Bajaj Racold |
| 17 | Heating Plates | Bajaj Johnson Racold |
| 18 | Electric Water Immersion Rod | Bajaj Racold |
| 19 | Electric Kettle | Bajaj Racold |
| 20 | Coffee Percolator | Bajaj Racold |
| 21 | Egg Boiler | Nita Navlight |
| 22 | Electric Toaster | Bajaj Racold Murphy |
| 23 | Electric Ovens | Bajaj Johnson Racold |
| 24 | Voltage Stabilizer | Bajaj Gem Weston |
| 25 | Refrigerator | Kelvinator Gem Godrej Allwyn Voltas |
| 26 | Room Cooler | Racold Gulmarg Bajaj |
| 27 | Electric Mixcer | Bajaj Racold |
| 28 | Geyser | Bajaj Johnson Racold |
| 29 | Washing Machine | Bajaj Johnson Racold |
| 30 | Air Conditioner | Voltas Bajaj Arco |
| 31 | Heat Convector | Bajaj Racold Sunflo |
| 32 | Cooking Range | Bajaj Johnson Racold |
| 33 | Vacuum Cleaner | Johnson |
| 34 | Emergency Light | Bajaj |
| 35 | Electric Gas Lighter | Bajaj |
| 36 | Hair drier | Bajaj Racold |
| 37 | Milk Cooker | Bajaj |